PlantFactory 2016

Reference Manual

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Section 1
Getting Started

What's New

New Features in PlantFactory 2016

PlantFactory 2016 offers many new features and enhancements.

You can find the list below, and additional information on the PlantFactory web page:

http://www.plantfactory-tech.com/overview/index.php

Release 4

- Multi-Polygonal Single Plane and Crossed-Plane leaves
  - Single Plane leaves have a grid based mesh (up to 8×8), which allows you to add more realism to your plant species in its finer details.
  - Crossed-Planes are ideal for representing complex plant geometry parts such as flower groups or dense foliage, yet are very effective in terms of polygon count and memory footprint. Crossed Plane is particularily suited for real-time engines.
- Multi-pass Rendering Improvements:
  - Optimized handling of semi-transparent materials to prevent background color to bleed within object mask color data
  - Embed alpha channel for each mask pass (when the output format supports it)

Producer

- Misc. UX/UI improvements:
  - Improved Export
  - Improved Sap inheritance
  - Added support for CPUs with more than 64 cores on Windows
  - Added wireframe display for billboards
  - Improved display of billboards backface
  - Enhanced image browsing
  - Improved hooking points placement for Blades

Release 3

- New features

   - Advanced vegetation pruning algorithms with new Cut probability, Cut length and Radius Reduction parameters
   - New Current Primitive node allows advanced control over branch growth and natural pruning effects
- UX/UI improvements:
   - Major performance/responsiveness/stability improvements
   - Better wireframe display, and improved gizmo manipulator interactions
   - Improved geometry loading and previewing
   - Improved vegetation painting
- Improved geometry transition algorithms:
   - Better handling of branch offset
   - Improved geometry continuity with highly distorted models
   - Displacement mapping now available on transition zones
- Improved exports:
   - New optional wind application to exported geometry
   - Improved export dialog interface
   - Improved PTex format export for plant materials

Release 2

- A new stylized meshing mode
   - Allows you to quickly and automatically generate a low polygon envelope version of your vegetation model.
   - Envelope resolution, smoothing and convexity quality are user configurable
- 3-Axis Billboard Leaves Rotation.

Release 1

- Growth simulation using biologic parameters
- Preset Variations
- Level Of Detail (LOD)
   - Automatic
   - User defined with the LOD selector node
- Additional parameters in the segment node

- Minimum length
- Branch distribution as absolute
- Texture mapping applied from branch top
- Interaction with ground

Installation

Installing the software

The Installation files of PlantFactory are downloaded in .zip file format. Unzipping this file into a work directory on your hard drive gives you all the files you need to install the software on your computer.

During installation, you have to enter the product's serial number; this is the number, in the form of "TPFxaaa-aaaaa-aaaaa-aaaaa-aaaaaa-aaa-xxxxx", that is emailed to you (where "a" represents a letter, and "x" represents a digit). Please note that this number is confidential, and should not be communicated to third parties. Should you require technical support or wish to download data from our [www.e-onsoftware.com website], you may be asked for this serial number or your product installation code.

You have the option of overriding the location of the installation of the program files and the content files. PlantFactory will run from any location you specify on a hard drive. If you enter a different location, and change your mind, there is a Reset button at the bottom of this dialog that will reset the location fields back to the default installation locations.

Also, during the installation process, you will have the choice of installing all of the software, or only parts of it. Since only what is necessary is actually installed on your hard-drive, we recommend you choose the Typical installation mode.

Activating the Software

The first time you open PlantFactory, you are prompted to register and activate the software. You have two options:

- **You can opt to automatically activate online:** This option attempts to connect to your e-on software account and activate the product there. A dialog displays to enter your e-on account login and password.
- **You can opt to activate your product manually:** Use this option if the machine you are running PlantFactory on is not connected to the Internet or if you have already received your Activation key file.
  - A screen displays with your INST- code. If you need to go to another machine to activate you will need this code to do it. If you have received an activation key file, you can point to it now to activate. Or activate online.
  - If you go to your account page to activate, you will receive an email with an activation key file attached. Place this key file in a directory that gets backed up frequently and is safe from accidental erasure. The next time you open

PlantFactory, click to locate the activation keyfile, locate it on your hard drive and your product will be activated.

Link with other e-on Products

PlantFactory can be linked with other e-on products such as: VUE, Carbon Scatter, LumenRT. This link allows these products to import plant created from your PlantFactory and edit imported plant directly into PlantFactory. A record of this link is placed on your account.

During activation, if you do have one of these e-on products installed, PlantFactory will try automatically to link with there softwares by connecting to your e-on software account.

If link between PlantFactory and other e-on products fails or if you do not have other e-on softwares installed while you are activating PlantFactory, PlantFactory will try again to link with other e-on prodcuts at each start.

System Requirements

PlantFactory is a 64 bit application, designed for the Windows® 64 bits XP, Vista, 7, 8, 8.1, 10 and Intel Mac OS X 10.7 or better platforms.

Like all 3D packages, it is highly demanding in terms of computer power. Although the application is totally multi-threaded to ensure the smoothest possible response, you have to realize that there is a lot going on when you work in PlantFactory. This is why we feel that running it on a reasonably recent and a reasonably fast computer is best suited. We recommend a minimum of 4GB of RAM.

Technical Support

Included Support

If you experience difficulties installing or using the software, the first thing we recommend is that you visit our website and read through the frequently asked questions to see if there is already an answer to your problem in there. If not, please visit the forum.

As a registered client of e-on software professional products, you benefit from the following standard support services:

- Complimentary 30 Day Maintenance,
- Phone-based installation troubleshooting for 90 days following your purchase,
- Knowledge Base and Frequent Question resources,
- Web-based Technical Support,
- Registered User Forums,
- Free Software Updates.

Complimentary 30 Day Maintenance

All purchases of PlantFactory include 30 days of complimentary maintenance. With the complimentary 30 Day Maintenance Plan, you receive:

- Unlimited, priority web-based technical support,
- Access to EEF releases (Expedited Engineering Fix),
- Free upgrades during the maintenance period (access to pre-release versions not included).

The 30 Day Maintenance Plan is automatically added to your account after the first activation of your product.

- If you decide to extend this 30 Day Maintenance by subscribing to a Standard Maintenance Plan, the yearly maintenance period will extend the 30 days, providing a total of 13 months coverage.

Standard Maintenance

This is an annual maintenance contract that includes a number of benefits:

- Free upgrades during the subscription period, including free upgrades to all .5 and full versions,

- Unlimited, priority web-based technical support,
- Access to EEF releases (Expedited Engineering Fix),
- Access to "Maintenance Only" forums.

When You Can Get Under Maintenance?

Since the annual subscription period starts from the date of activation of your copy of Vue, we recommend that you purchase maintenance together with your product, or that you add maintenance within 30 days of purchasing. This will offer you 13 months of Maintenance coverage.

If you don't purchase maintenance during this time, you will not be able to get your product under maintenance until you purchase an update for the product.

Updating

No software is ever perfect. This is why e-on software regularly releases software updates through its website. These updates can provide new features as well as bug fixes. Keeping your software up-to-date by regularly downloading and installing these updates is recommended for optimal performance.

Automatic Updates

Because keeping track of these updates can be a time consuming process, PlantFactory features an optional automatic updating technology. This technology requires that PlantFactory have access to the internet in order to connect to the e-on software website to periodically check for new updates. You can check for updates anytime on demand by selecting the menu command File | Check For Update. However, this again requires that PlantFactory have access to the internet.

If this is not the case, or you do not wish to authorize such connections for any reason, you will have to visit the Software Updates page of our website (Customer Care | Software Updates from our site menu) and manually retrieve the updates there.

If automatic updating is enabled, the application will periodically attempt to connect to the e-on software website to see if any software updates are available. If a new update is found on the e-on website, a short description of the update will appear so that you can decide whether or not you wish to install the update.

- If you decide to install the update, PlantFactory will download and install the update automatically.
- A backup of your software will be made so that you can remove the update if you decide that you don't want to keep it.

Please wait until the process completes before continuing.

If you don't want PlantFactory to check for new updates automatically, uncheck the corresponding option in the new update prompt or in the options panel.

Canceling Updates

If for any reason, you decide that you do not want to keep the last update, you can uninstall it and restore the previous version by selecting the menu command File | Cancel Last Update.

After a few minutes of processing, the update will be removed and the previous version restored.

Welcome Dialog

The *Welcome Dialog* appears when you open Vue.

Startup Screen

It displays the most recent files you've worked on for selection or you can browse to open another file.

There are links to various resources:

- **Kickstart Tutorial:** provides access to the beginning tutorial for PlantFactory.
- **Reference Manual:** accesses the PlantFactory wiki
- **My license:** displays the installation (INST-) code for this product.
- **Interface preset:** you can select a keyboard interface for PlantFactory that matches other software products like Max, Maya and others.

- **Preferences:** opens the PlantFactory Options page where you can set your preferences.
- **About this product:** displays product name, registered users name and the build number of the most current update applied.
- **e-on software Website:** displays the front page of the e-on website.
- **My account at e-on software:** opens your account page at e-on.
- **User Forum:** takes you to the Registered Users Forum at the e-on website.
- **Cornucopia 3D:** takes you to the first page of the www.cornucopia3d.com website.

If you don't want to see this dialog next time you launch PlantFactory, check the **Don't show this dialog again** option at the bottom of the dialog. If you decide you want to see it again, you can access the screen from the **Help>Show** startup panel option on the PlantFactory menu.

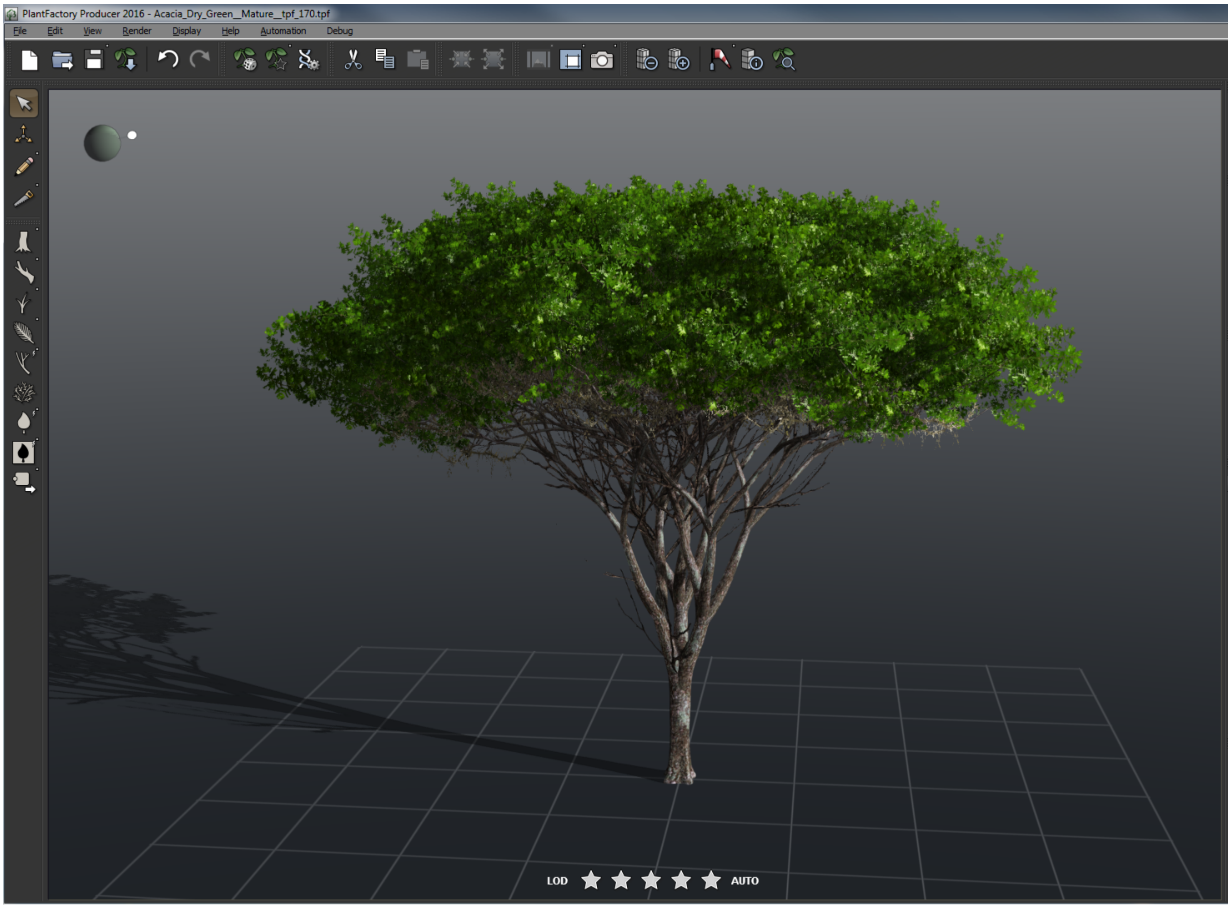
Section 2

Interface Overview

PlantFactory interface is made of mostly moveable, individual elements that can be for most of them arranged in a way that suits the user.

- Menu bar is located on the top of the window (Windows version). The basic commands are available here and cannot be moved. These are the commands **New**, **Open**, **Save/Save As**, **Export Plant**, **Undo** and **Redo**.
- Toolbars are made of buttons that allow quicker access to menu commands. They are always horizontal with the exception of node toolbars (Geometry Nodes, Control Nodes...). They may be shown, hidden or arranged at will in the main window.
- Dockable dialogs. Like the toolbars they can be managed by the user. You can find a description of the basic components of the Main Window.

Use PlantFactory Display menu to show or hide toolbars and dialogs.



Main Window

When you open PlantFactory for the first time, the main window or workspace is divided into several areas:

1 Preview Window

2 Getting Started Toolbar

3 Component

4 Graph Window

5 Information

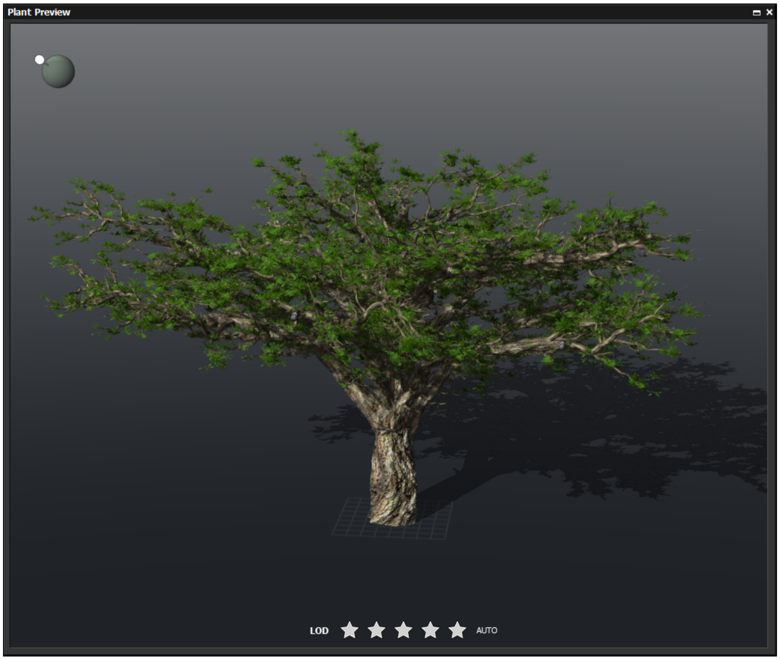
6 Global Plant Parameters

7 Node Parameters

8 Material Summary

These comprise the work areas of PlantFactory. Every parts of the workspace can be rearranged to suit your needs and the layout saved.

Preview Window



Preview Window

The preview window is your workspace for creating a plant. You can paint in that area or tweak the plant manually. If creating a plant using the procedural approach, this is where you see the results.

Painting is done in the **Preview window** workspace. You can paint in that area or tweak the plant manually. If creating a plant using the procedural approach, this is where you see the results. You will also find here the sun and bias gizmos. If your plant is compatible, you can control the Level Of Details of the plant geometry displayed in the preview.

If you press the right button on the mouse it will pop the draw menu, allowing to interact with the preview quickly.

Controls

Defaults controls in the preview are:

- **Zoom:** Control + Right Mouse Button
- **Panning:** Shift + Right Mouse Button
- **Rotate around object:** Middle Mouse Button
- **Rotate the camera:** Right Mouse Button
- **Move camera back/forth:** Mouse Wheel
- **Undo:** Control + Z
- **Redo:** Control + Y

It is possible to edit this settings in the Options and also in the Navigation controls dialog.

Render

The Preview window is also the render area. Select the render options using the Render icon of the Render Toolbar (right-click for settings), or select it from the menu.

Sun Gizmo

The **Sun Gizmo** is located at the top-left corner of the Preview window. It is made of two spheres :

- a small bright sphere representing the sun
- a big dark sphere representing the world the plant is growing on.

Left-click on the bright sphere and drag it around the bigger dark one to modify the sun direction. You will see the lighting and shadows change in the plant preview.

LOD Gizmo

The **LOD Gizmo** is located at the bottom of the Preview window. It allows to control the Level Of Details (LOD) of the plant geometry displayed in the preview.

The number of stars is linked with the number of LODs available. By clicking on a star, you can choose the level displayed. The higher the LOD value, the less precise the displayed plant geometry.

If **AUTO** is enable by clicking on it, LOD is chosen automatically depending on the position of the camera. In this scenario, empty stars reflect the LOD displayed.

The LOD number and transition distances can be edited in the meshing options

Note **this is only a display option**, it does not change the exported geometry. For that use the Meshing Options.

Getting Started Toolbar

Getting Started toolbar

The **Getting Started toolbar** contains the following features to get you started using PlantFactory.

- **KickStart:** this takes you to a video introduction to PlantFactory
- **Tutorials:** this takes you to PlantFactory tutorial page where PlantFactory tutorials are available.
- **Navigation Controls:** pops a dialog showing the camera's controls available in the preview.
- **Documentation:** opens the documentation of PlantFactory.
- **Advanced Mode:** changes the workspace and shows the control nodes in the graph (can be configured in the Options).

Navigation Controls

This panel displays the mouse shortcuts for the preview in PlantFactory.

Navigation Controls panel

This dialog shows the different camera movements available in the preview and their associated shortcuts. The shortcuts can be edited directly in this dialog by clicking on the labels or in the Operations Tab. The available movements are the following :

- **Orbit:** allows the camera to turn around a point in the scene.
- **Zoom:** changes the camera zoom.
- **Slide:** translates the camera.
- **Dolly:** moves the camera back and forth.
- **Rotate:** rotates the camera around itself.

Component

The **Component** dialog is used to add or paint components and geometry in your plant.

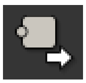
Component dialog

The preview shows the potential brush used by the drawing tool. When the preview is highlighted it means that the preview is in drawing mode and the item shown in the dialog is the current brush.

It is possible to change the brush by selecting a primitive in the preview or a node in the graph and then click in the Component's preview to apply changes to the brush. If you click on a node and then draw directly it will use the last used brush.

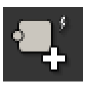
A quick way to draw preset nodes is to use the Preset toolbar. For more details about the draw tools please refer to this section.

The Component dialog contains the following buttons :

- 

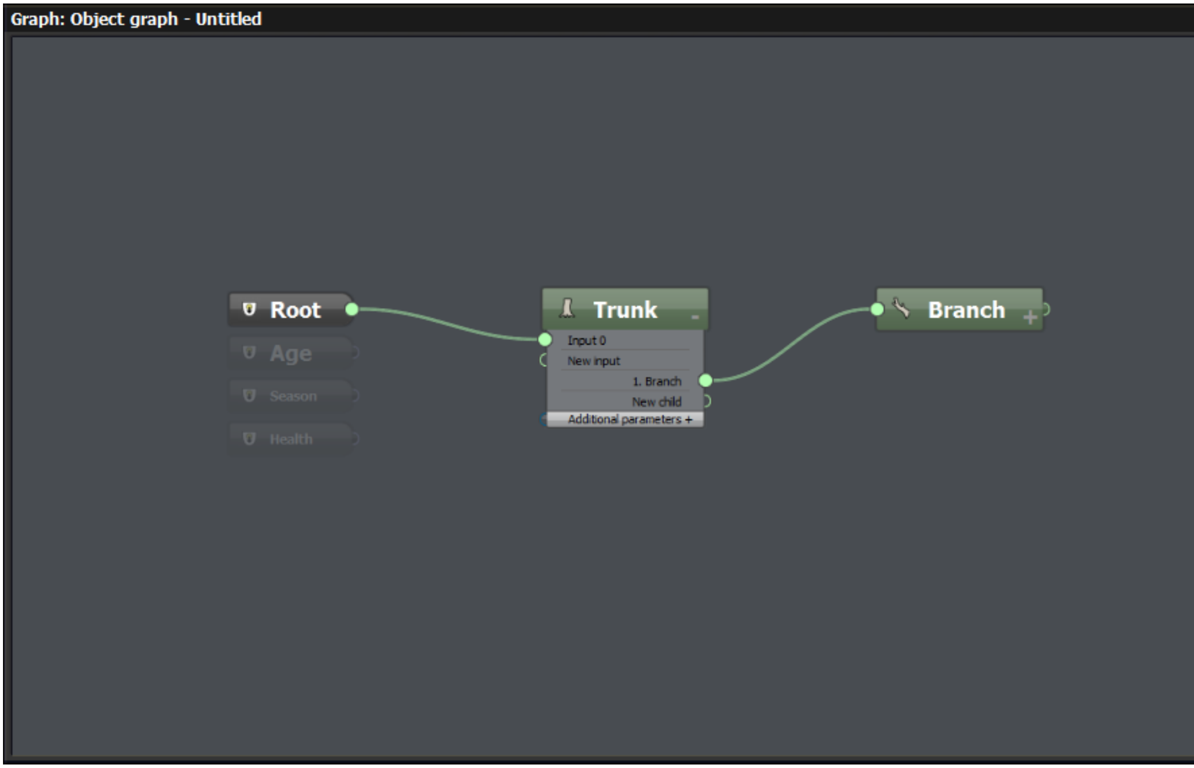
  Load component: opens the component browser and set the selected component as the drawing brush.
- 

  Drawing mode:

  - **Left-click:** Switch drawing mode on and off
  - **Right-click:** Opens the Draw Menu
- 

  Add to graph: adds and connects a component in the graph.

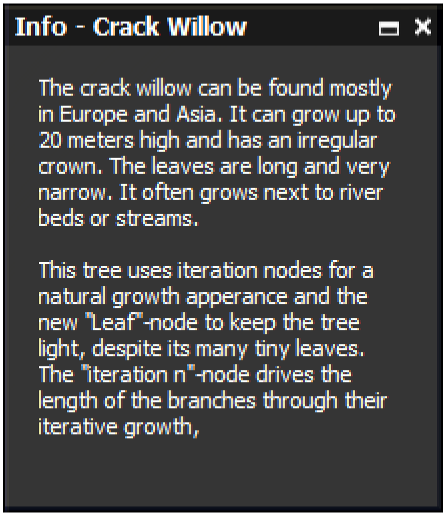
Graph Window



The Graph window displays a visual representation of a plant (or material) using a set of interconnected nodes. These nodes not only visually represent the parts of the plant but plants can be build by creating and connecting these nodes (in Producer and Studio only).

When PlantFactory starts, there are usually nodes for Root, Age, Season and Health displayed. One segment, representing a tree trunk, is also displayed. This is the default display.

Information



Information

This dialog shows the title and description of the opened file.

If a node is selected, the title and description of this node is displayed.

If selected node have no description, documentation on the node type is displayed.

It is possible to directly edit the description of the file or the selected node by clicking on the description in the dialog.

Global Plant Parameters

The Global Plant Parameters are the basis for all other parameters applied to the plant. These settings are accessed by selecting the corresponding menu commands:

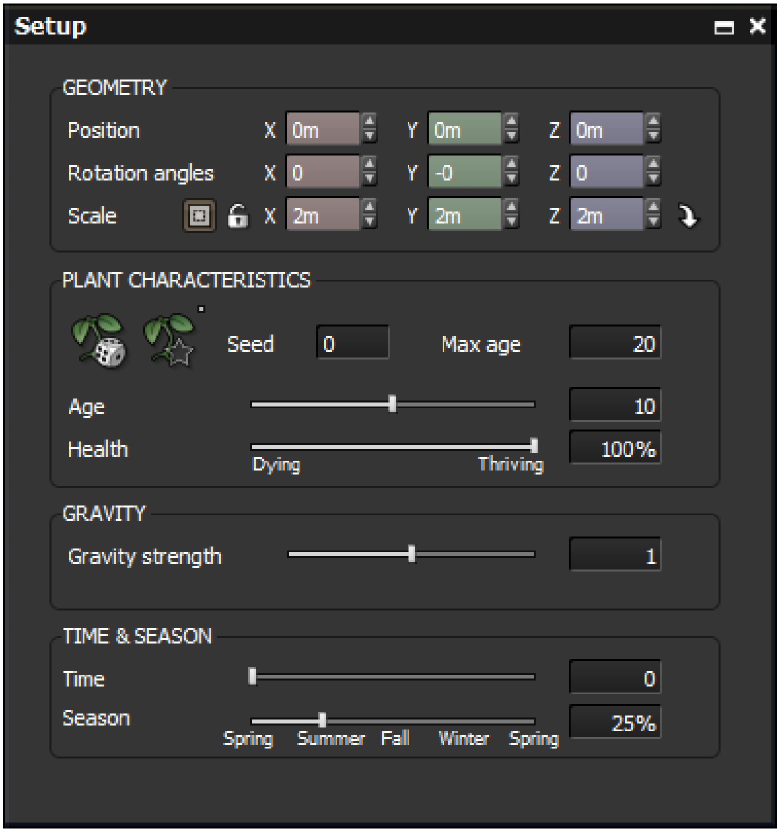
1 General Parameters

2 Global Biases

3 Wind Settings

4 Meshing Options

General Parameters



General Parameters Tab

Geometry

- **Position:** enter the root position in x, y, z values.
- **Rotation Angles:** enter the angle of rotation in x, y, z values.
- **Scale:** change the scale of part or all of the root using x, y, z values.
- **True dimensions:** display scale using true dimensions (instead of factor)
- **Lock:** keep scale ratio

- **Bake size:** Apply scale factors on graph parameters and reset scale factor to 1.

Characteristics

- **New seed:** set a new random seed
- **Flag this plant:** store the current plant variation in Flagged variations
- **Max age:** enter the maximum age of the plant. Plant age could be defined between 0 and this value.
- **Age:** enter the age of the plant using the slider to change value. The age will then be accessible in the graph using the Age input node.
- **Health:** enter the general health of the plant using the slider. The plant health will then be accessible in the graph using the Health input node.

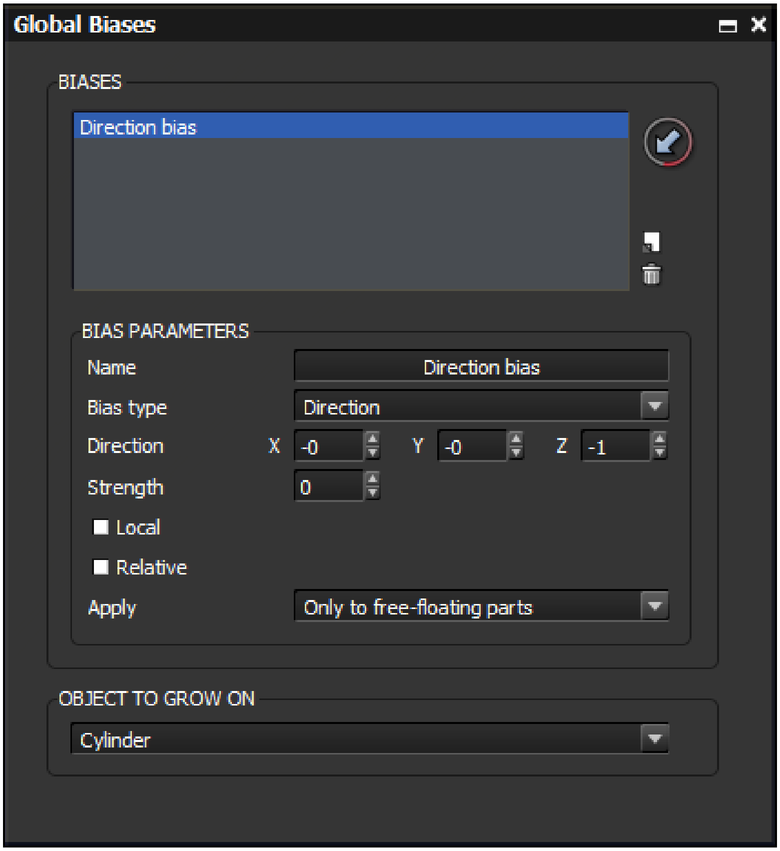
Gravity

- **Gravity strength:** enter the gravitational pull on the root. “1” is the default value. This gravity value acts as a global multiplier to the impact of gravity on each primitive instance.

Time & Season

- **Time:** set the current date using the slider. The time will then be accessible in the graph using the Time input node.
- **Season:** select the season of the year. The season will then be accessible in the graph using the Season input node.

Global Biases



Global biases

Biases

A bias is a tendency of a plant to react in a certain way. A bias toward a direction causes a plan to favor leaning in one direction over another one.

- **Directional:** Select the name of the bias to display the following parameters:
- **Name:** name of the selected bias.
- **Bias type:** types of local biases are:
  - **Direction:** makes the segment bend.
  - **Planar:** makes the segment grow as if trying to align itself with a plane.

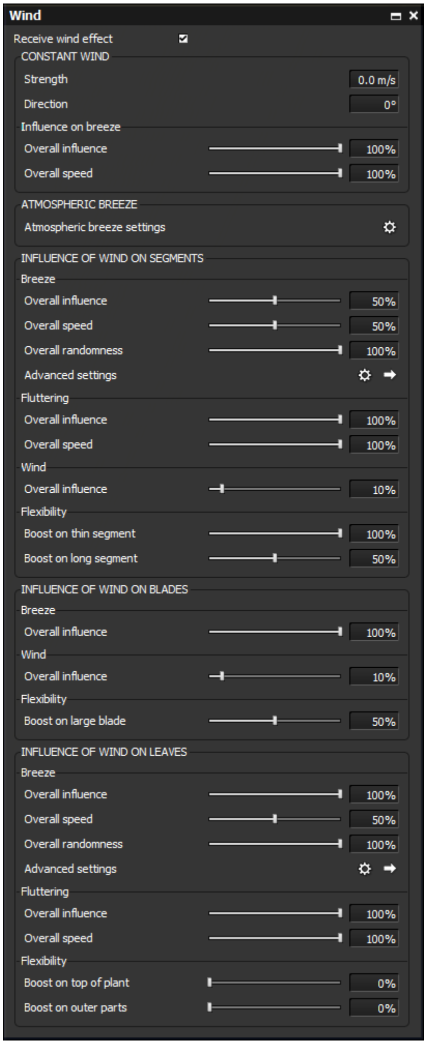
- **Attractor:** attracts the segment towards a point.
- **Axis repeller:** makes the segment grow as far away as possible from an axis.
- **Swirl:** makes the segment gently swirl.
- **Curl:** influences segment growth as to create loops or loop fractions.
- **Twist:** rotates the segment around its axis.

- **Direction:** direction associated to the local bias.
- **Strength:** strength of the local bias. Variance can be specified.
- **Local:** tells which coordinates system is used for direction definition.
- **Relative:** if checked, the force amount will be made dependent on the segment length.
- **Apply:** there are three application choices:
  - **Only to free floating parts:** the local bias is applied only to the segment parts that don't grow on the object.
  - **To entire segment:** the local bias is applied on the whole segment.
  - **Only to parts growing on object:** The local bias applies only to the parts growing on the object.

Object to Grow on

After importing an object for the plant to grow on, select it here. This will add a node to the graph.

Wind Settings



Wind

Plant can be animated using wind effect. To activate the wind animation mechanism, you need to check **Receive wind effect**.

This animation is based on three effects:

- **Breeze:** small waving of the plant caused by ambient breeze.

- **Fluttering:** small quivering of the plant caused by gust of winds
- **Wind:** huge deformation of the plant caused by wind

Constant Wind

- **Strength:** set strength value of the constant Vue-like wind vector.
- **Direction:** set direction value of the constant Vue-like wind vector.

Influence on breeze

If you look at the way a plant moves in the wind, you will notice that the amount of random movement increases with the intensity of the wind. This effect is captured by TPF's breeze model, and the settings in this group let you control the way the intensity of the wind influences the breeze:

- **Overall influence:** this setting controls the overall relationship that exists between the intensity of the wind and that of the breeze. Low values mean that the intensity of the breeze increases only slightly as the intensity of the wind increases. This is appropriate if you want to simulate the deformation of a tree under wind without causing random "noise" in that deformation. High values mean that the intensity of the wind will be strongly influenced by that of the breeze. Strong winds will cause strong random movements of the plant around the wind direction.
- **Overall speed:** this setting controls the influence of the wind on the overall frequency of the movements caused by the breeze. If the value is low, the frequency of the random movements will be the same, whatever the intensity of the wind. If the value is high, strong winds will cause faster random movement of the plant.

Atmospheric Breeze

- **Atmospheric breeze settings:** Click the icon to display the Wind Editor to configure custom atmospheric breeze settings.

Influence of Wind on Segments

Breeze

- **Overall influence:** controls the breeze intensity on the body of segments.
- **Overall speed:** controls the breeze frequency on the body of segments.
- **Overall randomness:** controls the breeze randomness on the body of segments.
- **Advanced settings:** click the Edit icon to open the *Advanced Breeze Response* or click the arrow to open a Browser and select any saved advanced breeze settings.

Fluttering

- **Overall influence:** controls the breeze intensity during gust of winds on the body of segments.
- **Overall speed:** controls the breeze frequency during gust of winds on the body of segments.

Wind

- **Overall influence:** controls the wind intensity on the body of segments.

Flexibility

- **Boost on thin segment:** controls the influence of segment radius on wind intensity.
- **Boost on long segment:** controls the influence of segment length on wind intensity.

Influence of Wind on Blades

Breeze

- **Overall influence:** controls the breeze intensity on blades.

Wind

- **Overall influence:** controls the wind intensity on blades.

Flexibility

- **Boost on large blade:** controls the influence of blade width on wind intensity.

Influence of Wind on Leaves

Breeze

- **Overall influence:** controls the breeze intensity on leaves.
- **Overall speed:** controls the breeze frequency on leaves.
- **Overall randomness:** controls the breeze randomness on leaves.
- **Advanced settings:** click the Edit icon to open the *Advanced Breeze Response* or click the arrow to open a Browser and select any saved advanced breeze settings.

Fluttering

- **Overall influence:** controls the breeze intensity during gust of winds on leaves.

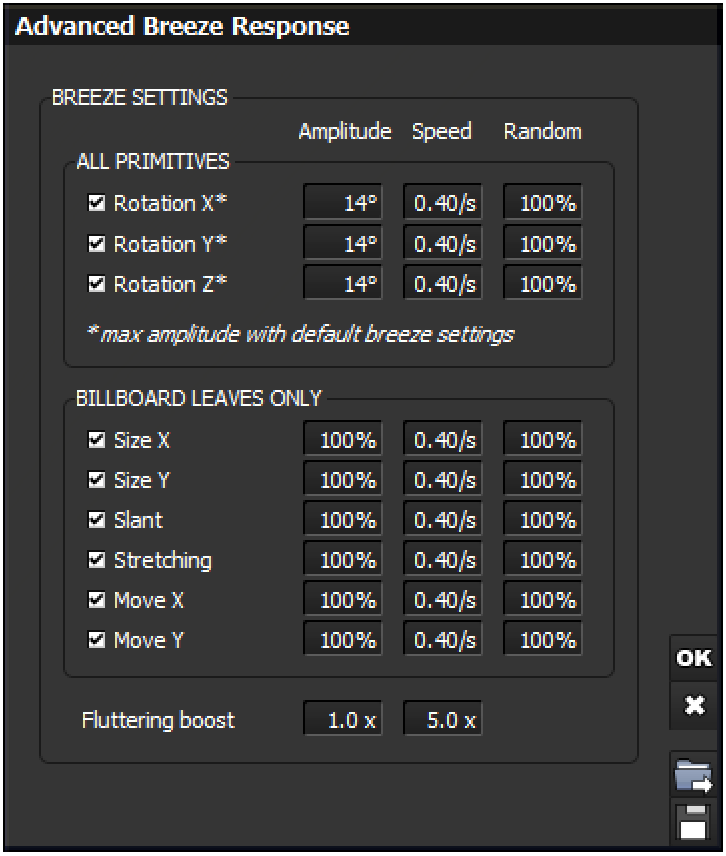
- **Overall speed:** controls the breeze frequency during gust of winds on leaves.

Flexibility

- **Boost on top of plant:** controls how much more leaves located high on the plant should be affected by breeze.
- **Boost on outer parts:** controls how much more leaves located far from the plant axis should be affected by breeze.

Avanced Breeze Response

Description



Leaves Wind Settings

This dialog allows to configure how plant primitive should react to the breeze. For main wind settings, please refer to the Wind tab of the Plant root node.

Some effects (**Billboards Leaves** frame) are only valid for leaves always facing the camera. Wind strength can be set in these nodes, allowing a more precise control.

If **Simple wind** was set, it is possible to preview it using the display toolbar.

Effects parametrization

The wind strength depend on time. This strength affect all the cyclical effects of this dialog.

For each effect, different settings may be set:

- **Amplitude:** relative strength of the effect
- **Speed:** frequency of the effect (number of cycles per second)
- **Randomn:** indicates whether the cycles are synchronized

All effects can be individually disabled by unchecking the button at the beginning of each line.

Axes for the effects

Most effects refer to X, Y, Z axes.

- For blllboards always facing the camera, Z is the direction towards the camera and X, Y are in the screen plane.
- In all other cases, these axes are those of the local base.

All Primitives

- **Rotations X, Y, Z:** rotates the primitives around the X, Y and Z axes.

Billboard Leaves only

These settings only apply to leaves facing the camera.

- **Size X, Y:** rescales the billboard in both screen directions.
- **Slant:** moves the billboard lower and upper edges horizontally in opposite directions, distorting the billboard laterally
- **Stretching:** moves the billboard corners along its diagonals. When a diagonal gets longer, the other gets shorter.
- **Move X, Y:** globally translates the billboard in both screen directions.

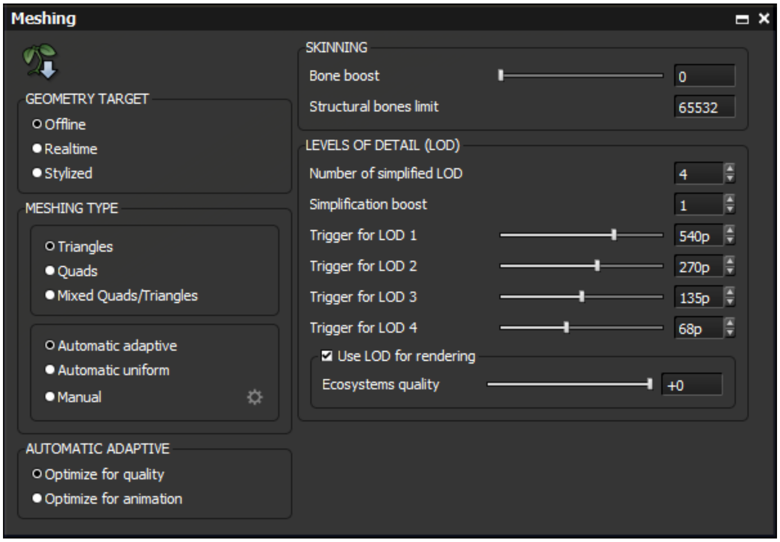
Fluttering boost

These boost settings are applied to every effects during gust of winds.

Load / Save

The advanced breeze settings can be saved to disk using the Save button (.bws format). Load them in another plant if you want to share them.

Meshing Options



Meshing

Introduction

This panel contains polygon generation options for the plant. You can produce triangle or quad based meshes using several strategies.

In addition to this panel, the **global resolution** for the plant is adjusted using the subdive buttons in Display Options.

Note you can click the **Export plant** icon to display the Export Options dialog:

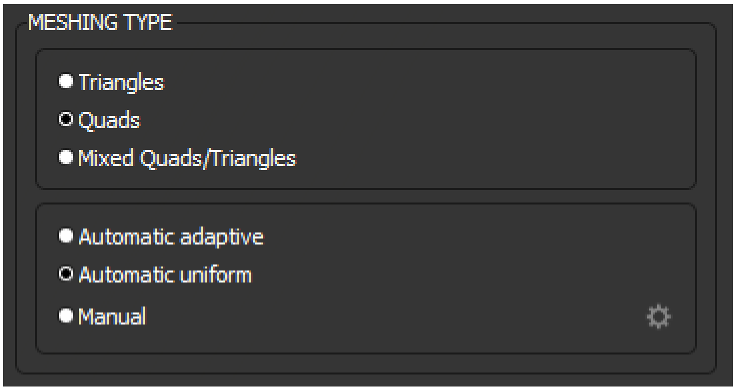
Geometry Target

Designer, Studio, Producer

- **Offline:** generates geometry optimized for offline rendering. VUE rendering uses this geometry.
- **Realtime:** generates geometry optimized for realtime rendering. LumenRT rendering uses this geometry.
- **Stylized:** generates simplified geometry optimized for sketch rendering.

Meshing Type

Studio, Producer…



- **Triangles:** generates geometry using triangles
- **Quads:** generates geometry using mainly quads (triangles can be used in rare cases). Subdivision based on quads are more regular as the ones based on triangles (but less efficient)
- **Mixed Quads/Triangles:** generates geometry using mainly quads but allows the use of triangles in some cases to avoid deformations of the mesh.
- **Automatic adaptative:** subdivision is automatically computed to suite best ge-

ometry complexity.

…Studio, Producer

- **Automatic uniform:** subdivision is automatically computed to suite best geometry complexity while keeping a uniform mesh overall.
- **Manual:** subdivision is controlled by parameters defined in each node. It is possible to change globally every subdivision parameters using the **Manual meshing advanced option** button.

Automatic Adaptative

In automatic adaptative subidivision mode, one **optimization mode** among those should be set :

- **Optimize for quality:** should be enabled if the plant will be used for static renders that involve no deformation. The subdivision will be best suited to avoid creating useless polygons.
- **Optimize for animation:** should be enabled if the plant is used with heavy deformations like wind, or for export with the purpose of animating it. This option ensures geometrical consistency even under strong rig deformation.

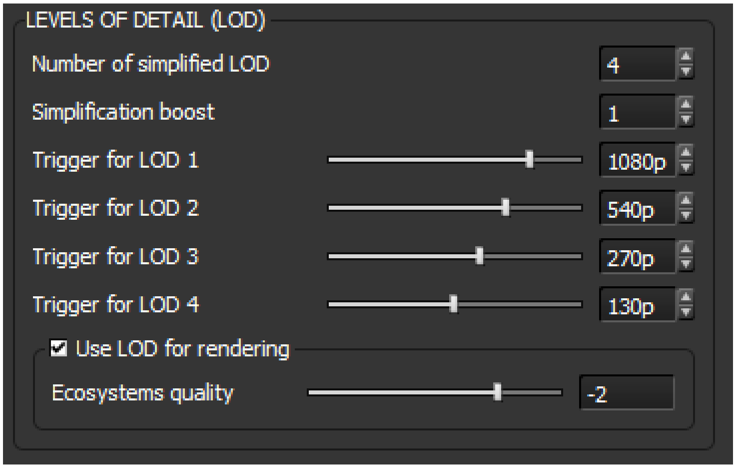
Skinning

- **Bone boost:** global scale of how many bones are created for all parts of the plant. This can be overriden in each Segment node for finer tuning.
- **Structural bones limit:** limits the number of bones generated on the plant for a better control of the optimization of the plant.

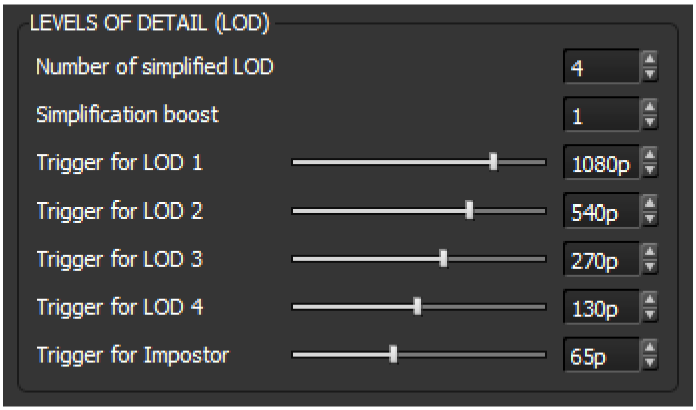
Studio, Producer…

Level of Detail (LOD)

...Studio, Producer...



Offline geometry



Realtime geometry

- **Number of simplified LOD:** Number of simplified LOD available. It means there will be n+1 LOD.
- **Simplification boost:** Simplification between each LOD, 1 will reduce the polygon count between each LOD by about 4, 2 by 16, 3 by 64...
- **Trigger for LOD i:** Threshold in pixels to display LOD i. The LOD is selected when the apparent size of the bounding sphere of the plant is below that value. Note that the bounding sphere is usually a bit larger than the actual plant shape

on screen.

…Studio, Producer

- **Use LOD for rendering:** The plant mesh used for rendering will be chosen using LOD rules.
- **Ecosystems quality:** Sets the amount of simplification for EcoSystems. Setting +0 means the EcoSystems instances created in Vue from this species will be as polygon-heavy as individual plants. The lower the value, the more simplified the EcoSystems instances will be : fewer polygons, fewer details.
- **Trigger for Impostor:** Threshold in pixels to display an impostor instead of a mesh. Impostors are automatically generated for a variety of points of view.

LumenRT Export

Producer

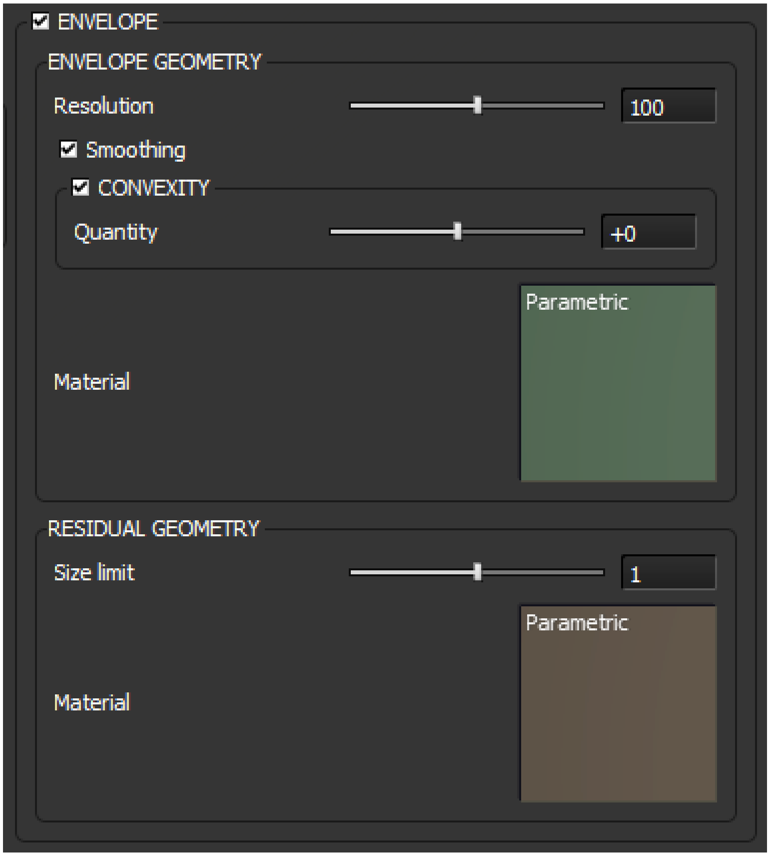
These parameters are specific for export to LumenRT (Realtime geometry)

- **Max map resolution:** defines the resolution max of the plant material textures used in LumenRT display engine.

Designer, Studio, Producer…

Envelope

…Designer, Studio, Producer…



Envelope is a simplified shape representing all small primitives of the plant (leaves and small branches). All big primitives of the plant (trunk and main branches) stay the same but with a very low resolution (Residual Geometry).

Envelope Geometry

- **Resolution:** defines the number of polygons used for envelope.
- **Smoothing:** defines if the envelope geometry is smoothed (residual geometry will use the same value)
- **Convexity:** defines if the envelope is a rounded shape

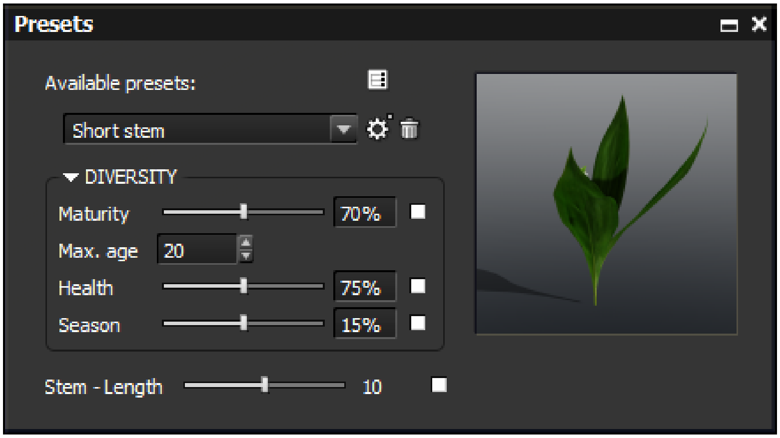
- **Matrerial:** defines the material applied on the envelope geometry

...Designer, Studio, Producer

Residual Geometry

- **Size limit:** defines the maximum size above which primitives are excluded from envelope geometry.
- **Material:** defines the material applied on the residual geometry.

Presets



Presets

This dialog allows to define different preset of your plant based on:

- **Diversity parameters:** such as Maturity, Maximum age, Season, and Health.
- **Published Parameters:** List of all published parameters of your graph. If groups have been defined, they will be used for parameter layout. You can display only external published parameters by clicking on the parameter icon.

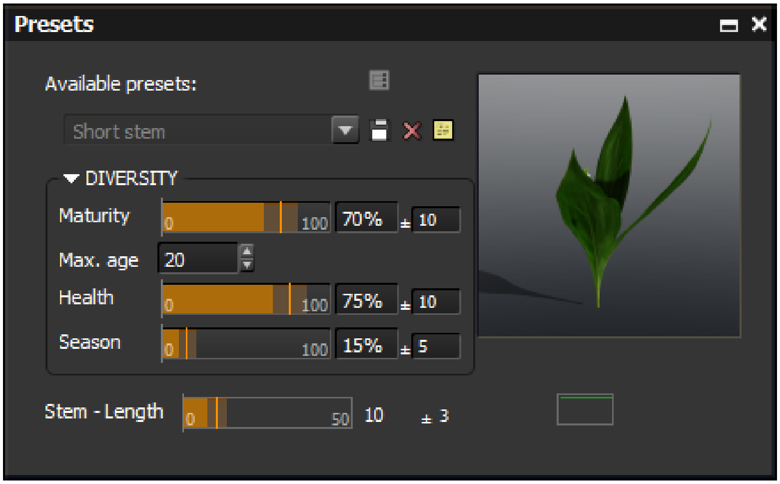
If several presets are available, the **available presets** list allows to choose a preset.

When a preset is selected, only parameters with random values can be edited to force a specific value inside the defined range. To reset an edited value to random, click on the **reset** check box on the right of the parameter.

To edit any parameter of the current preset, click on the **edit** button.

The **trash** button can be used to delete the current preset.

Preset Edition



Preset Edition

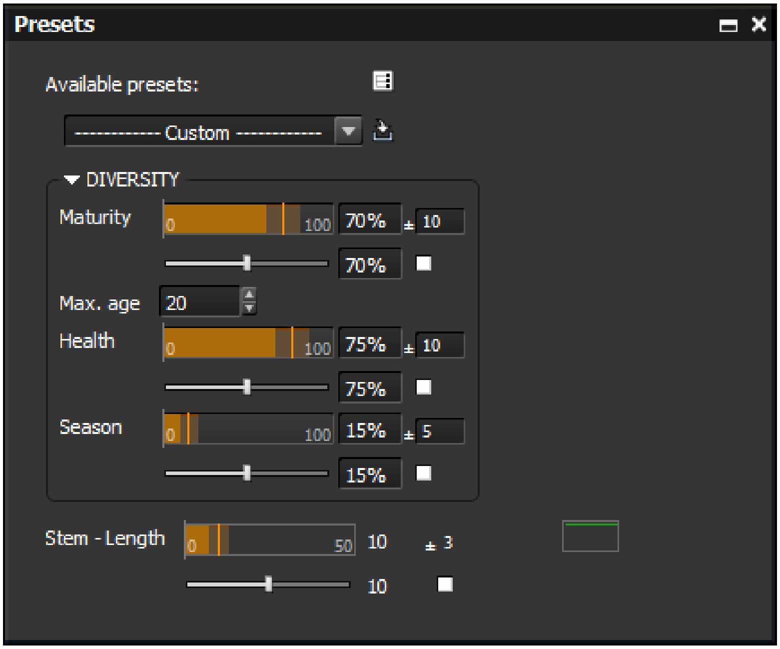
The **note** button can be used to write a description of the preset. This description is displayed in the tooltip of the preview.

When done, store the changes using the **save** button.

Cancel modifications using **cancel** button.

By clicking on the preview, you can opt to take a new capture from the preview or to use a custom picture.

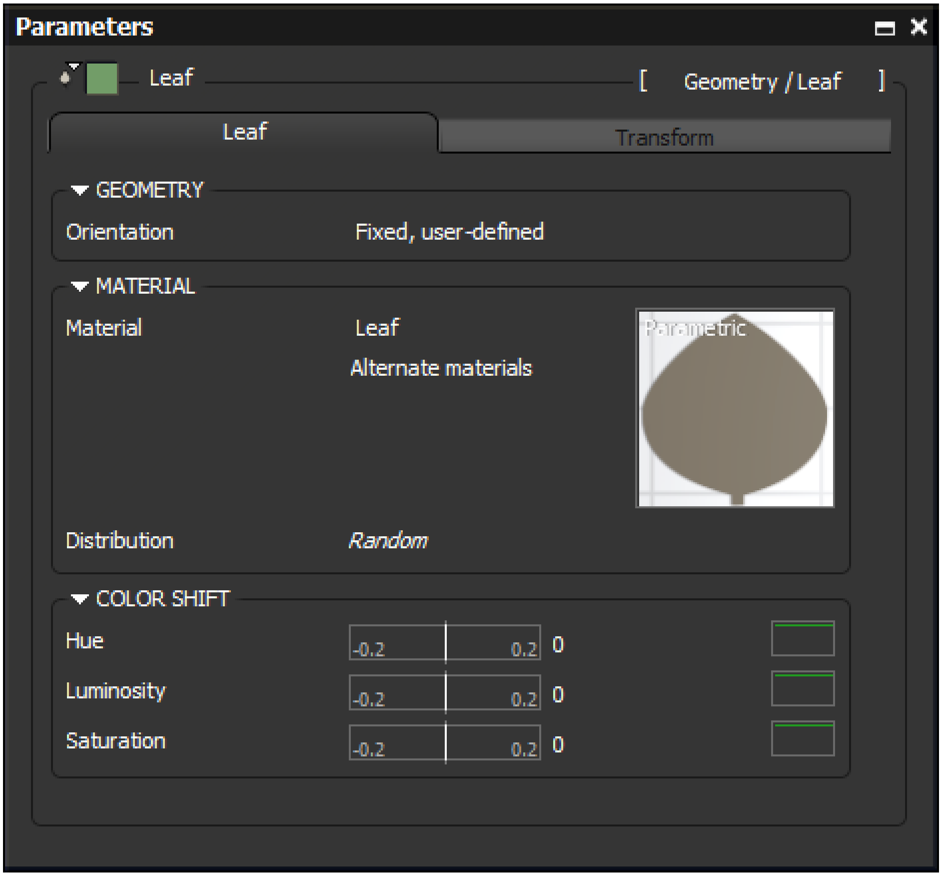
Custom Preset



Custom Preset

If no preset is selected, **Custom** preset display all parameters available. You can create a new preset using **store** button or only play with the parameters to create easily variation of your plant.

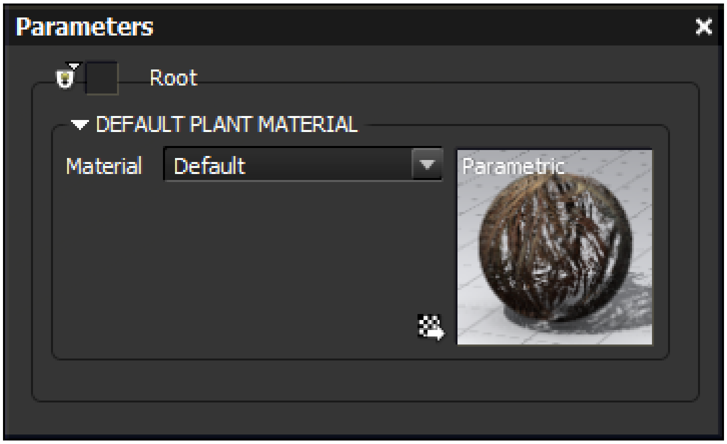
Node Parameters



This window displays all Parameters available for the currently selected node in the Graph window.

Root node

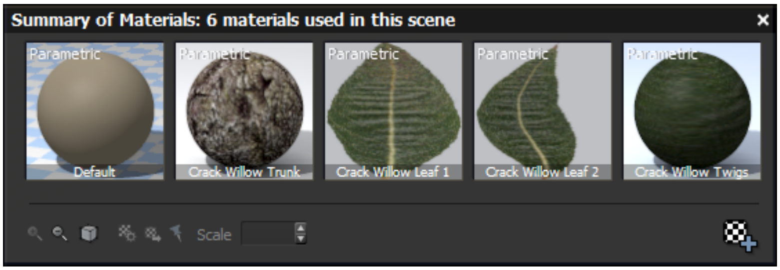
When the root node is selected, a special parameter is visible: the plant's default material. This allows you to set the material that will be assigned by default to your current plant.



Read about the Material parameter and the Material editor to know more.

Material Summary

The **Summary of Materials** dialog displays a list of all the materials used in the scene at a given time.



Summary of Materials

It is displayed by selecting the menu command **Material Summary**.

You may navigate through the displayed list using the scrollbar at the bottom of the dialog.

Right-click on a material to display a menu with **Edit**, **Copy**, **Load** and **Save** options.

Loading, Editing and Scaling Materials

Materials can be loaded, edited or scaled using the **Summary of Materials**.

Double-click on the material to open the Material Editor for the selected material, or right-click to display a menu and choose **Edit** there.

The **Load** material icon opens the Materials Browser so that you can replace the selected material. To load a new material in place of another one, click the corresponding **Load** material icon and select a new material from the Material Browser. All objects that used the old material will now use the new one. If you are using bitmaps, use the **Edit** function to open the Material Editor and change the bitmap.

Change the scale of a material using the **Scale** control under the displayed material.

You can drag from one material onto another to make all the objects that used the old material use the new one (notice how the old material, having now become useless, disappears from the list).

Material deletion and locking

The material deletion is automatically handled, which means when a material is not affected to a node it will be deleted automatically. If you want to avoid this behaviour on some materials it is possible to pin each material in order to prevent any unwanted deletion. If the pin icon is clicked it locks the material, meaning that even if the material is not attached to an object it will not be destroyed as long as it is pinned.

Adding a material

The button **Add Material** create a new material pinned by default and it opens the Materials Browser in order to load a material in this new space.

Menus

File

The File menu displays the following options:

- **New:** creates a new plant
- **Open:** opens a browser displaying existing scenes (.tpfp or .tpfs) (see TPF File Formats)
- **Save:** save current scene (.tpfp or .tpfs) (see TPF File Formats)
- **Save as:** save current scene as a different file
- **Recent files:** lists recent scenes
- **Import:** the import has the following options:
  - **Import Component:** use this to import a vegetation component
  - **Import Mesh:** use this to import a mesh
- **Export:** the export has the following options:
  - **Export as Mesh:** this displays the Export Options panel. From this dialog, you can export plants or objects in .3ds, .obj and .fbx format
  - **Export as Component:** this exports a plant or the selected part of a plant in .tpc format for later use in The Plant Factory
  - **Export as VUE Species:** this allows you to save your work in .tpf format
  - **Export as VUE Object:** this allows you to save your work in Vue object format (.vob)
  - **Export as VUE Mesh:** this allows you to save your work in Vue object format (.vob)
  - **Export Presets:** this exports any of the presets that have been defined for this plant
  - **Export To LumenRT:** this exports the plant for use in LumenRT 2015
  - **Export as C3D Item:** this allows you to save your work in Cornucopia object format (.tpfc3d).
  - **Share On Exchange Area:** this displays the Share on Exchange Area panel. From this dialog, you can upload and share your work on CORNUCOPIA3D Exchange Area
  - **Send To A Friend:** this displays the Send To A Friend panel. From this

dialog, you can upload your work privately on CORNUCOPIA3D and share it freely with a friend

- **Delete imported meshes:** use this option to delete any imported meshes.
- **Apply to Vue:** use this option to copy your work to Vue, if Plant Factory was launched from Vue
- **Check For update:** Check the e-on website to see if an update has been published
- **Cancel Last update:** Like all e-on products, you have the possibility to roll back if an update does not work as expected
- **Options:** displays the Options panel
- **Exit:** exits the Plant Factory.

Edit

The Edit menu displays the following options:

- **Active Tool:** use to select a tool.
  - **Select:** activates the select tool
  - **Paint:** activates the paint tool
  - **Paint Once:** activates the paint tool for one action
  - **Prune:** activates the prune tool
  - **Prune Once:** activates the prune tool for one action
  - **Touch-Up:** activates touch-up mode.
- **Cut:** cuts the selected nodes and put them into the clipboard.
- **Copy:** copies the selected nodes and put them into the clipboard.
- **Paste:** copies the clipboard nodes into the graph.
- **Group:** creates a meta-node from the selection.
- **Ungroup:** replaces the selected meta-node by the nodes it contains.
- **Undo:** cancels last modification.
- **Redo:** replays last cancelled modification.
- **New Plant Variation:** creates a new variation of the plant currently in the workspace.

View

The View menu displays the following options:

- **Go to Plant Root:** selects the plant root and displays the parameters
- **Node:** has the following options:
  - **Hide Geometry:** allows to block evaluation of the selected nodes. Useful to analyze parts of the graph.
  - **Minimize in Graph:** allows to shrink the selected nodes to their minimal size.
  - **Load Icon Picture:** allows to load a picture for each of the selected nodes.
  - **Use Current Preview as Icon:** takes a screenshot of the current preview and sets it as picture for each of the selected nodes.
  - **Preview Options:** for material graphs, shows the Preview Options dialog.
- **Graph:** has the following options for using and viewing the graph:
  - **Enable Advanced Menu:** if this option is unchecked, only preset nodes can be created from Graph contextual menus.
  - **Display Nodes Minimized:** if this option is checked, all nodes will be displayed with the smallest possible size.
  - **Create Nodes Minimized:** if this option is checked, newly-created nodes will be created with the smallest possible size. This option is checked if **Display Nodes Minimized** is checked.
  - **Auto-Connect Geometry nodes:** if this option is checked, newly-created geometry nodes will be automatically connected to the existing graph.
  - **Force Align Input/Output Nodes:** if this option is checked, input and output nodes will always be vertically aligned.
  - **Constrain Nodes to Grid:** if this option is checked, the nodes will not be allowed to float freely in the graph. Their positions will be constrained to a grid instead.
  - **Zoom Entire Graph:** acts on graph position and zoom to make sure the graph best fits its window.
  - **Zoom Graph Area:** allows to draw a rectangle on the graph and to zoom this part of the graph.
  - **Zoom In Graph:** zooms in.
  - **Zoom Out Graph:** zooms out.
  - **Tooltips:** enables or disables node and parameter tooltips.

  - **Node Preview Options:** for material graphs, shows the Preview Options dialog.

- **Preview:** has the following options:

  - **Hide Branches:** hides the bodies of all segments in the plant preview.
  - **Hide Billboards:** hides all billboards in the plant preview.
  - **Hide Blades:** hides the blades of all segments as well as all warpboards in the plant preview.
  - **Hide Objects:** hides all objects in the plant preview.
  - **Show More:** clicking on this icon brings parts back that were removed.
  - **Show Less:** removes hierarchically lower parts of the plant.
  - **Subdivide More:** Shows more detail.
  - **Subdivide Less:** shows less detail.
  - **Highlight Selection:** highlights the selected node on the plant so you can see the correspondence of the node to the plant.
  - **Show Node Color on Plant:** shows the selected plant part in the same color as the corresponding node.
  - **Show Wireframe:** displays the plant in wireframe.
  - **Display Shadows:** shows plant shadow.
  - **Preview Displacement:** allows for material displacement preview.
  - **Show Normals:** displays normals.
  - **Preview Wind:** previews wind effects.
  - **Show Export Rig:** if plant has rigging, displays this rigging.
  - **Hide the Discarded Transitions on Plant:** hide the transitions that are not possible due to space limitation on a plant.
  - **Show Grid:** displays grid on ground.
  - **Show Information:** displays polygon and billboard count and plant size in scene.
  - **Show Ruler:** shows the ruler for scale checking.
  - **Show Bias Controls:** shows bias controls for editing.
  - **Clip Plant Underground:** shows plant parts under the ground.
  - **Zoom Entire Plant:** makes the plant fit the preview viewport.

- **Previewing:** has the following options:
  - **Draft+Standard:** a temporary lower quality plant will be built for edition preview.
  - **Standard Only:** the quality of the preview of the plant is always the same.
  - **Draft Only:** the quality of the preview of the plant is always lower than usual.
- **Disable Automatic Updating of Preview:** sets whether the plant should recomputed every time its graph is modified or not.
- **Update Now:** if Automatic Update is off and the plant graph was modified, force plant regeneration.

- **Close Sub-graph:** saves and closes current sub-graph.
- **Cancel Sub-graph:** closes current sub-graph without saving.
- **Gizmos:** has the following options:
  - **Position Gizmo:** allows to translate the object along its three axes.
  - **Rotation Gizmo:** allows to rotate the object around its three axes.
  - **Size Gizmo:** allows to rescale the object along its three axes.

Render

The Render menu displays the following options:

- **Render:** renders the contents of the preview area using the current settings in the Render Options dialog.
- **Render Options:** this options displays the Render Options dialog.
- **Display Last Render:** this displays the last render, either in the workspace window or in the Render Display dialog.
- **Render Animation:** this displays the Animation Render Options window.

Producer

Display

The Display menu lists the various parts of the user interface. Here you can choose to display certain windows.

- **Lock Workspace:** locks the current workspace layout, disabling window rearrangement.

- **Workspace:** has the following options:
  - **Simple:** basic workspace layout for getting started.
  - **Advanced:** recommended workspace layout for advanced users.
  - **Load Workspace:** loads a workspace layout that has been saved.
  - **Save Workspace:** saves a workspace layout.
- **ToolBars:** has the following options:
  1 File Export
  2 Clipboard
  3 Sub-graph tools
  4 Group Ungroup Nodes
  5 Plant Settings
  6 Geometry Nodes
  7 Advanced Geometry Nodes
  8 Control Nodes
  9 Node Presets 
  10 Tools
  11 Display Options
  12 Advanced Display Options
  13 Render
- **Getting Started:** displays the Getting Started Toolbar.
- **Info:** displays the Information area.
- **Graph:** displays the Graph area.
- **Parameters:** displays the Node Parameters area.
- **Preview:** displays the Preview area.
- **Material Summary:** displays the Summary of Materials dialog.
- **Component:** displays the Component dialog.
- **Node Selector:** lists the Nodes Selector.
- **Node Observer:** displays the Node Observer.
- **Imported Elements:** displays the Imported Elements dialog.
- **Atmosphere Editor:** this displays the Atmosphere Editor windows.
- **General Parameters:** displays the General Parameters area.

- **Parameters:** displays the Global Biases area.
- **Parameters:** displays the Wind Settings area.
- **Parameters:** displays the Meshing Options area.
- **Parameters:** displays the Presets area.
- **Render Stack:** displays the Rendering Dialog dialog.
- **Interface Colors:** displays the Interface Colors dialog.

Help

The Help menu displays options to help you when using The Plant Factory.

- **Getting Started:**
  - **Kickstart Tutorial:** opens a tutorial to help get your started in The Plant Factory
  - **Draw a Plant:** opens the Browser for you to select a scene that illustrates drawing a plant.
  - **Load a Plant:** opens the Browser for you to select a plant to load
  - **Tutorials:** connects you to online product tutorials.
- **Overview:** connects you to this wiki
- **www.e-onsoftware.com:** connects you to e-on software web-site
- **About the Plant Factory:** displays version, build number and installation code.

Interface Colors

Interface Color Editor

You can modify the colors of the different interface items as follows:

- **Dialog background:** the background color of dialogs.
- **Text:** the color of the dialog text.

- **View background:** the color of the background of the 3D Views.
- **Main selection:** the color of the main segment selected.
- **Child selection:** the color of the child segment selected.
- **View caption (active):** the background color of the active view's title bar. Inactive view title bars have the same background color as the rest of the interface.
- **View caption text (active):** the color of the text in the active view's title bar.
- **View caption text (inactive):** the color of the text in inactive view title bars.
- **Caption (active):** the background color of active dialog title bars.
- **Caption (inactive):** the background color of inactive dialog title bars.
- **Caption text (active):** the color of the title text in active dialog title bars.
- **Caption text (inactive):** the color of the title text in inactive dialog title bars.
- **Radio/check text (checked):** the color of the text of all radio and checkboxes when the control is selected.
- **Radio/check text (default):** the color of the text of all radio and checkboxes when the control is not selected.
- **Tab (active):** the color of the background of the current tab (usually the same as the background color).
- **Tab (inactive):** the color of the background of the non-current tabs.
- **Tab text (active):** the color of the text of the current tab.
- **Tab text (inactive):** the color of the text of the non-current tabs.
- **Edit field text:** the color of text in edit fields.
- **Edit field text highlighting:** the color of selected text in the edit fields.
- **Edit field back (active):** the color of the background of active edit fields.
- **Edit field back (inactive):** the color of the background of inactive edit fields.
- **Button text:** the color of the text of buttons.
- **Button back:** the color of the back of buttons.
- **Button back (highlight):** the color of the back of buttons when the mouse is above the button.
- **Button back (toggled):** the color of the back of buttons when the button is toggled.
- **List item text:** the color of text in list boxes.

- **List item text (selected):** the color of selected text in list boxes.
- **List back (active):** the color of the background of active list boxes.
- **List back (inactive):** the color of the background of inactive list boxes.
- **List selected item back:** the color of the background of selected text in list boxes.
- **List column title:** the color of the background of the column titles in multi-column list boxes.
- **Menu text:** the color of the text of menu items.
- **Menu text (selected item):** the color of the text of selected menu items.
- **Menu back:** the color of the menu background.
- **Menu back (selected item):** the color of the background of selected menu items.
- **Graph background:** the color of the graph section background.
- **Slider positive value:** the color on the slider for a positive value.
- **Slider positive range:** the color for a positive range.
- **Slider negative value:** the color on the slider for a negative value.
- **Slider negative range:** the color for a negative range.
- **Slider outline:** the color of the slider outline.
- **Slider bounds (highlight):** the color of the highlighted slider boundary markers
- **Slider bounds:** the color of the non-highlighted slider boundary markers.
- **Slider negative line:** the color of the negative slider line.
- **Slider zero line:** the color of the zero slider line.
- **Slider positive line:** the color of the positive slider line.
- **Parameter name:** the color of the name of parameter
- **Published parameter name:** the color of the name of a published parameter
- **Connect parameter:** the color of a connect parameter on the graph.
- **Random dependency range:** the color of random dependency range on the graph.
- **Geometry nodes:** the color of control nodes on the graph.
- **Control nodes:** the color of control nodes on the graph.
- **Loop nodes:** the color of loop nodes on the graph.
- **Spline nodes:** the color of spline nodes on the graph.

- **Other nodes:** the color of nodes not listed here on the graph.
- **Curve miniature border:** the color of a curve miniature border.
- **Primal curve:** the color of a primal curve.
- **Parent curve:** the color of a parent curve.
- **Radial curve:** the color of a radial curve.
- **Angular curve:** the color of an angular curve.
- **WireFrame:** the color of the wireframe in the preview.
- **Discarded transitions:** the color of the discarded transitions when the option is activated.

Changes are previewed interactively in the Interface Colors dialog. If you want to preview color changes in the entire interface, click the **Apply** button.

New, Load, Save

Press the **New** icon to reset the interface colors to the default gray interface.

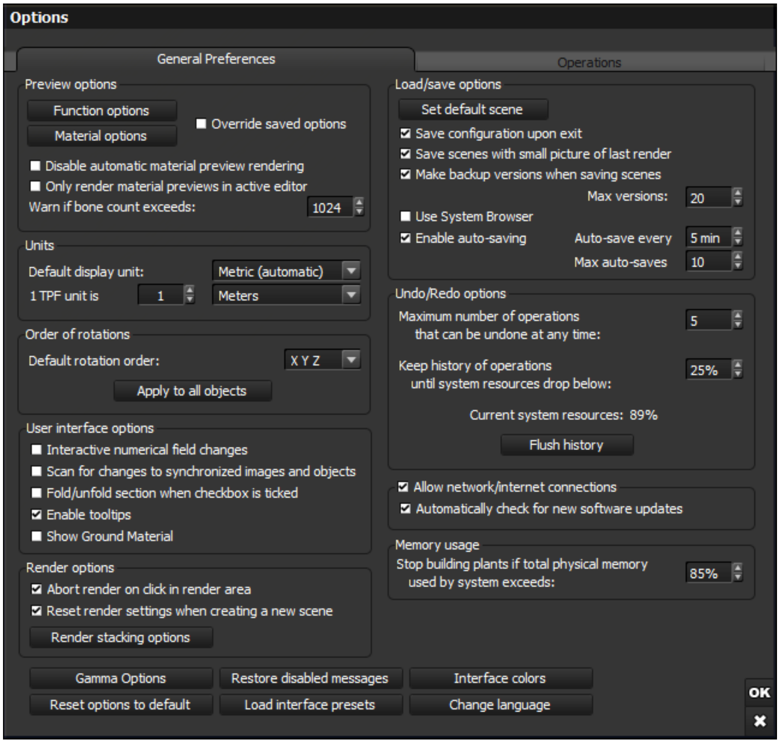
Click **Load** to load a preset interface color scheme. A Standard File Browser will appear letting you load the desired color scheme. Interface color schemes have the .ics extension.

Click **Save** to save the current settings for future use. A Standard File Browser will appear letting you set the name of the color scheme. Interface color schemes have the .ics extension.

Options

This panel displays the general preferences for PlantFactory.

General Preferences Tab



Options Dialog – General Preferences Tab

- **Preview Options:** The controls in this group let you customize the previews of materials and functions, using the Preview Options dialog.
  - **Override saved options:** If you select this option, when you load a material or a function, these options will override those that were saved together with the material or function.
  - **Disable automatic material preview rendering:** If you check this option option, material preview will no longer be generated automatically. Whenever a material preview becomes obsolete, a small triangle will appear on top of it. Simply click the preview to update it. Depending on your work habits, this option can be useful if you find that your computer is having difficulties keeping all materials up to date as you work.
  - **Only render material previews in active editor:** Checking this option is useful if your system becomes very slow when editing complex hierarchies of materials. When this option is selected, only the material or function previews

that are in the topmost editor are refreshed.

- **Warn if bone count exceeds:** let you set the number of bones you judge enough to pop-up a warning when using wind.

- **Units:**
  - **Default display units:** this drop-down list box lets you define which measurement unit will be used to display lengths.
  - **1 Vue unit is:** use the TPF unit setting to precisely specify how long a TPF unit will be.
- **Order of rotations:**
  - **Default rotation order:** this drop-down list box lets you define the order in which the rotations will be applied for all the new objects you create.
  - **Apply to all objects:** if you want to change the order of rotations for all existing objects, click this button.
- **Graph Editor Preferences:**
  - **Fold/Unfold parameters when checkbox is checked:** if this option is activated, when you enable/disable a list of parameters in a node it will unfold/fold the list of parameters accordingly.
  - **Enable tooltips:** enable or disable the tooltips in the graph preview.
  - **Show the control nodes in the graph:** show or hide the control nodes or the nodes not currently used in the graph. This option triggers automatically when clicking in **Advanced Mode** in the Getting started window.
  - **Show Ground Material:** show or hide the ground material in the Material Summary.
- **Render Options:**
  - **Abort render on click in render area:** setting this will allow you to stop a render by clicking in the render area.
  - **Reset render settings when creating a new scene:** when you create a new render, render settings are automatically reset to default. Unchecking this box will disable this feature.
  - **Save scenes with small picture of last render:** when you save a scene, TPF stores a thumbnail preview of it inside the file. This is then used in the Scene Browser. Disabling this option yields black previews for all your scenes.
  - **Render stacking options:** this button turns the render stacking feature on the render panel on and off and specified what images are stacked. For more information, refer to the Render Stack Options.
- **Gamma options:** click this button to display the Gamma Options dialog.

- **Reset options to default:** reset the options to match the default status.
- **Restore disable messages:** allows to show once again the windows who had the **Don't show again** checked.
- **Interface colors:** shows a dialog that allows to change the color of many windows and items in PlantFactory.
- **Load interface presets:** allows to load an interface preset from the following :
  - Default
  - 3DS Max
  - Cinema 4D
  - Flat Grey
  - LightWave
  - Maya
  - Softimage
  - ThePlantFactory 2014.6
- **Change language:** click this button to change the interface's language. You will have to restart the application for the change to take effect.
- **Load/save options:**
  - **Set default scene:** when this option is enabled, a default scene is automatically created upon startup. You can make the current scene become the default scene by pressing the **Set default scene** button.
  - **Save configuration upon exit:** unchecking this will prevent TPF from saving your configuration when you exit the software. It is not recommended.
  - **Save scenes with small picture of last render:** when you save a scene, TPF stores a thumbnail preview of it inside the file. This is then used in the Scene Browser. Disabling this option yields black previews for all your scenes.
  - **Make backup copies (.bak) when saving scenes:** unchecking this box prevents TPF from making a backup copy of your landscape when you save it. Although making a backup is good habit, since it can avoid losing data, you may want to turn this feature off because of the extra disk space used. Backup copies have the .bak extension instead of .tpfp or .tpfs. To restore a backup scene, simply replace the extension with .tpfp or .tpfs.
  - **Numbered backups:** when this option is selected, TPF will create several backup versions of your scenes, with numbered extensions: .bak, .bak2, .bak3... Each time you save the scene, the number of existing backups is incremented (.bak becomes .bak2, .bak2 becomes .bak3, and so on). You can adjust the

total number of backups of a given file using the Max backups setting.

- **Undo/Redo options:**

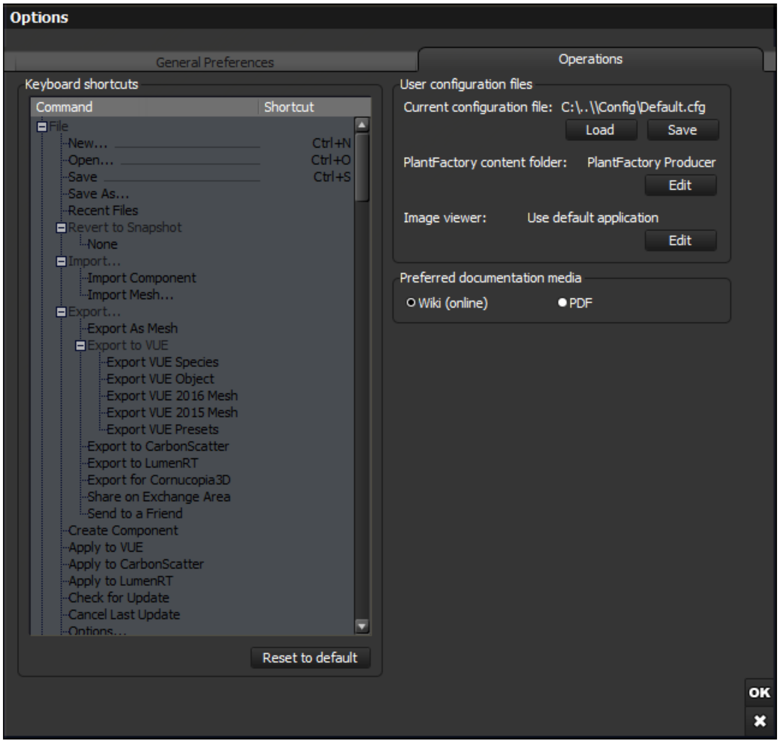
  - **Maximum number of operations that can be undone at any time:** this setting controls the number of operations that you can undo by hitting the Undo button in the Top Toolbar. Provided system resources are sufficient (see below), you will be able to undo/redo that number of operations at any time.
  - **Keep history of operations until system resources drop below:** this option lets you configure the maximum system resources that can be used before TPF stops storing undo/redo operations. When system resources drop low, the number of operations that can be undone may be reduced. The default value is 25%; you shouldn't set this to 0%, as it will eventually lead to a total system lockup.
  - **Current system resources:** this displays the percentage of current system resources available.
  - **Flush history:** this discards all undo/redo operations and frees some system resources.

- **Allow network/internet connections:** if you disable this option, TPF will never attempt to connect to your local network or the e-on software website. We recommend that you do not forbid network/internet connections, as this would adversely impact your TPF experience.

  - The options in this group control the way TPF connects to your local network or the e-on software website. TPF regularly connects to the e-on software website in order to check for software updates, new content and fresh news/tutorials. TPF only connects to the e-on software website, and any exchange of information is both secure and in keeping with e-on software's privacy policy (you can review this policy at http: //www.e-onsoftware.com/privacy).
  - **Automatically check for new software updates:** if you disable this option, you won't be notified when new updates are available for your software (new automatic updates are never installed without your prior approval). You should visit the e-on website regularly in order to perform software updates manually.

- **Interactive numerical field changes:** if this option is selected (the default), the interface is automatically updated as you enter numerical values in the input fields. If you prefer that the interface is updated only when you have finished entering the value and press Enter or switch to another control, deselect this option.

Operations Tab



Options Dialog – Operations Tab

This tab lets you redefine keyboard shortcuts for all keyboard operations and store these settings in user configuration files.

If you wish to emulate the Right Mouse Button (RMB) using "Ctrl+Left/Default button" for mouse and trackpad, check the box at the top of the dialog. This is available for both Windows and Mac computers. On the Mac, this should be very useful when using a trackpad.

For Windows machines, the Windows key can now be used and assigned a shortcut. Both keys, on either side of the keyboard, are treated as the same key. A keystroke assigned to this key would be listed as 'Win+t" for example. The Windows key must have another key assigned to it as a combination. Otherwise, it's function reverts back to displaying the menu.

For Macs, the Command and Control keys can be mapped independently to shortcuts.

Customizing Keyboard Shortcuts

This section lets you create new or alternate shortcuts for various commands. That way you can reassign the shortcuts you are most used to in your other applications.

In the Keyboard shortcuts list appear all the menu commands with their existing shortcuts alongside them.

To create a new or alternate keyboard shortcut, simply click on the line and type your new shortcut. If the shortcut is already assigned to another command, a prompt will appear, asking what you would like to do.

Click outside the list of commands to close the "Type new shortcut" invitation. If you want to remove an existing shortcut, right click (Cmd + Click on Mac) on the shortcut to be removed.

By pressing the Reset to default button, you can reset all the shortcuts to the factory settings.

Keyboard shortcuts can be saved in user configuration files (see below).

User Configuration Files

You can save and restore all your keyboard settings in a user configuration file. That way, several people working on the same computer can have different shortcut mappings. You can also take the configuration file with you to another computer and restore it there to keep your preferred keyboard mapping.

User configuration files are stored in the Environment folder, and have the extension .cfg.

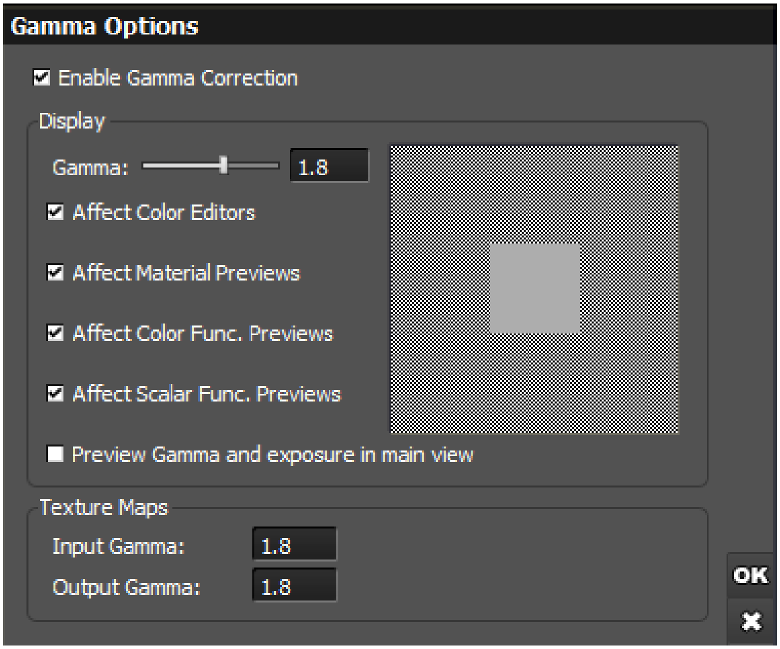
Click the Load button to display a Standard File Browser and load the desired configuration file. Likewise, the Save button will let you select a new file to store the current user configuration.

Preferred documentation media

Documentation for The Plant Factory is available in two formats – a PDF file and an online wiki. You can select which you prefer to see when you hit the Help key. Check either **Wiki (online)** or **PDF**.

The PDF file can be found in the application files, in the /Documentation subdirectory. You can always make a copy of that file and paste it to the Desktop for a quick and handy reference.

Gamma Options



Gamma Options Dialog

The Gamma correction feature lets you specify the input and output gamma that TPF will use internally. The gamma correction is an operation applied to intensities, to transform them from a nonlinear space to a linear one (and inversely).

Monitors, cameras, and all of the other devices that display or capture images are non-linear by nature. When displaying a mid-gray value on a monitor, for instance, the intensity of light that is actually displayed on the screen is not half of the one of a pure white. To compensate for this, a gamma correction is introduced so that the above becomes true.

In Computer Graphics, this has an important effect on the rendering engines, as all of the computations should really be computed in linear space, which can provide a more accurate realism when contributions from several lights are added, for instance.

You can choose to save the images with this gamma correction applied. But in some cases, you may want to keep the image in linear space so that you can open the image in another application and disable the input gamma correction in the input of the other application. Only at the end of the pipeline, you then add a gamma correction corresponding to the device on which you want to display your image.

Using gamma correction, you can be assured that all people working on a scene will see the same result, even when monitors have different behaviors. When accessed from the Options panel, the gamma settings become global settings which can be changed for specific images using the **Post Render Options** panel.

Enable gamma correction: this is a global setting that enables/disables the entire gamma correction option.

Display: using these controls you can specify the gamma correction that TPF needs to apply to the displayed images.

Gamma: use the slider to setup the gamma correction by referring to the preview on the right. When the square area within the preview matches the intensity of the surrounding area, the gamma is correctly set. By default, the gamma correction is only applied to the render. Using the next options you can extend the gamma correction to:

- The Color Editors
- The Material Previews
- The Color Function Previews
- The Scalar Function Previews

Preview Gamma and exposure in main view: checking this option allows you to preview the gamma settings in the Preview window.

Texture Maps

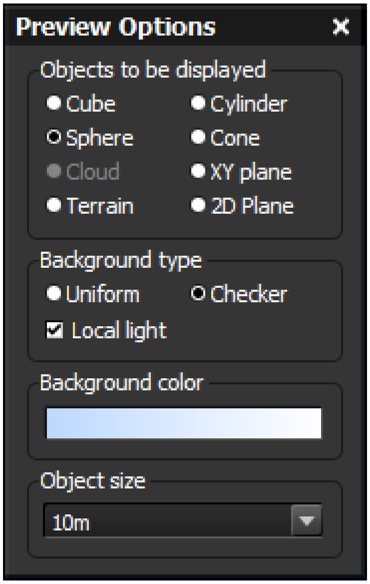
Input Gamma: the gamma correction that is applied to all of the bitmaps that will be loaded in the render engine. For any texture map node, even one eventually connected to the color output node, evaluating through either its grayscale or alpha output won't apply gamma correction. Only its color output will be gamma corrected.

Output Gamma: gamma correction that is applied to the render output. Once you have set up these options, you can still choose to change the gamma on a per-image basis in the case of Input textures. If you want to override the gamma for a specific texture map, you can switch from the system gamma (set up here) to a specific setting by choosing the Override Gamma option located to the right of the image preview in the Material Editor or any texture map nodes in the Function Editor.

Rendering

Gamma settings can also be applied to your finished render by adjusting the settings using the Edit button by the slider showing the Current Display Gamma.

Preview Options



Preview Options

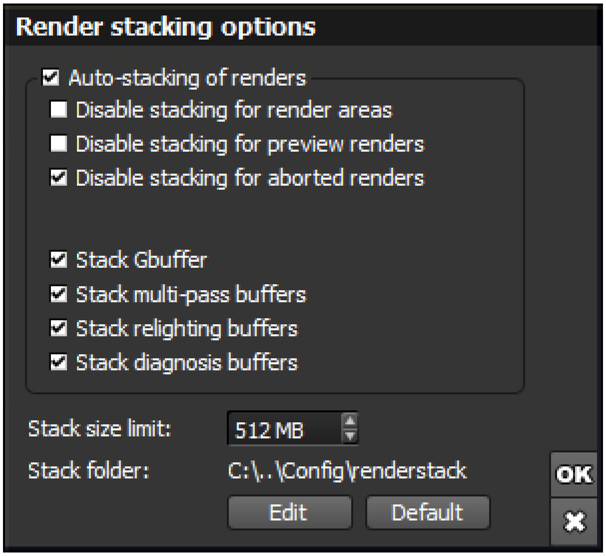
This dialog enables you to select which object should be used to preview materials or functions. **Sphere** is the fastest, and **Cloud** should only be used for cloud materials. **XY Plane** displays a 2D representation of the material in perspective, whereas **2D Plane** presents the material on a plane seen from above.

It also lets you choose a background type for the preview (**Uniform** or **Checker**), as well as the **Background color** by modifying the color map (double-click on the map).

Check **Local light** to use a local light rather than a directional light.

Zoom: Clicking the Zoom icon ( ) displays an enlarged view of the material. Click on Render to re-render the preview; press **Esc** to stop.

Render Stack Options



Render stacking options

In the **Render stacking options** dialog, you can turn on and off automatic render saving.

If *auto-stacking* is on, you can access the following options:

- **Disable stacking for render areas:** render using render areas will not be saved
- **Disable stacking for preview renders:** render in preview mode will not be saved
- **Disable stacking for aborted renders:** aborted render will not be saved
- **Stack Gbuffer:** Gbuffer information will be saved too
- **Stack multi-pass buffers:** multi-pass information will be saved too
- **Stack relighting buffers:** relighting information will be saved too
- **Stack diagnosis buffers:** diagnosis information will be saved too

Producer

Stack size limit: you can control how much can be stacked by limiting the size of the storage.

Stack folder: The default folder for storing these stacked renders is

- on a Windows computer :

`c:\user\[username]\appdata\Roaming\e-on software\Plant Factory [version]\config\renderstack`

- and on the Mac :

`/users/[username]/library/application support/e-on software/Plant Factory [version]/config/renderstack`

On both types of computers, these are hidden directories. In Windows, this feature can be turned on in

Window folders options. This location can be changed to another location if you wish by entering the pathname here.

Contextual Menus

This section contains all the contextual menu you can encounter in Plant Factory. Most of them are shortcuts that summarize the main features available in some context.

Here is a list of the contextual menus in Plant Factory :

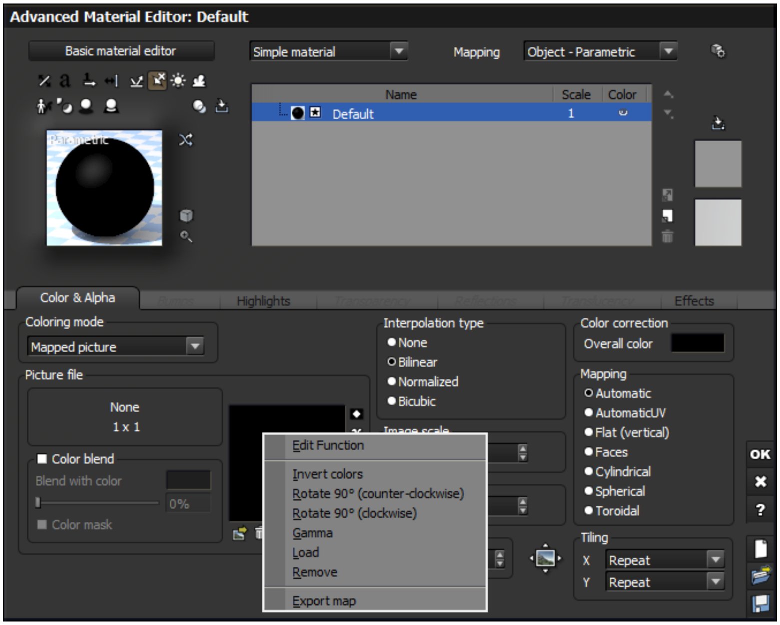
- **Preview window:** contains shortcuts for painting and adding components to the plant.
- **Nodes:** a quick interaction and customization of the graph is possible with this menu.
- **Materials preview:** basic operations for materials and textures.
- **Profile (Axis/Section):** basic operations for axis/section/profile in compatible nodes.

Axis Section Profile

It is possible to quickly load or save any section, profile or axis from this menu instead of using the buttons in each specific dialog. By clicking on the right button over an edit icon for axis/section/profile the menu will pop-up with the following items :

- **Copy:** copy the data contained in this node.
- **Paste:** paste the data in the buffer.
- **Save:** save the current data as a .axi/.s3D/.s2D file.
- **Load:** load any .axi/.s3D/.s2D file.
- **Reset:** destroy the current axis/section/profile and set the default value.

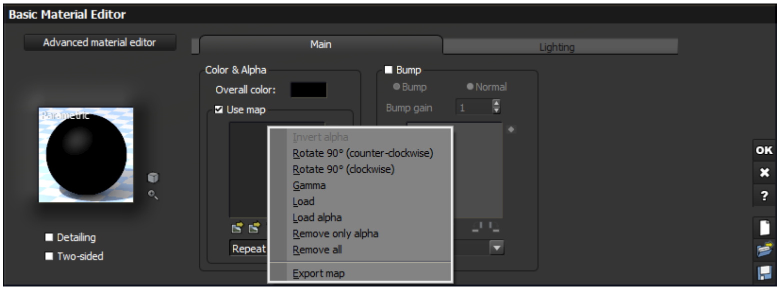
Color Map



Contextual menu in the advanced editor for editing a material

This contextual menu gives access to all the essential tools to manage the colormap of a material. It is available in the advanced material editor in the Color & Alpha tab. It contains the following items :

- **Edit Function:** allow to edit the function graph of the color map.
- **Invert colors:** invert the colors of the map.
- **Rotate 90° (counter-clockwise):** rotate the color map by 90° in the counter-clockwise direction.
- **Rotate 90° (clockwise):** rotate the color map by 90° in the clockwise direction.
- **Gamma:** open the menu to edit the gamma parameter.
- **Load:** open a load dialog to load a color map.
- **Remove:** remove the current color map.
- **Export map:** export the current color map as a picture.

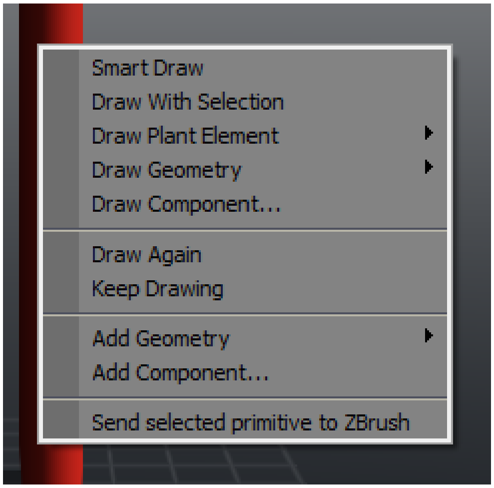


Contextual menu in the basic editor for editing a material

In the basic material editor the color map and the alpha map can be mixed together. In this case the menu changes a little :

- **Invert alpha:** invert the alpha map.
- **Rotate 90° (counter-clockwise):** rotate the color map by 90° in the counter-clockwise direction.
- **Rotate 90° (clockwise):** rotate the color map by 90° in the clockwise direction.
- **Gamma:** open the menu to edit the gamma parameter.
- **Load:** open a load dialog to load a color map.
- **Load alpha:** open a load dialog to load an alpha map.
- **Remove only alpha:** remove the current alpha map.
- **Remove all:** remove the current color map and alpha map.
- **Export map:** export the current color map as a picture.

Draw Menu



Contextual menu for drawing

This contextual menu lists all the essential tools to paint any component very quickly. It contains the following items :

- **Smart Draw:** draws using the automatic mode. In automatic mode the painted component depends on where you start painting.
- **Draw With Selection:** draws with the selected primitive as a brush.
- **Draw Plant Element:** draws with any of the primitives inside the popup menu. Those primitives are the ones from the plant.
- **Draw Geometry:** draws a node preset.
- **Draw Component:** opens the component browser and draws with the selected component.
- **Draw Again:** draws the current component once.
- **Keep Drawing:** draws the current component more than once.
- **Add Geometry:** adds and connects a geometry node to the graph.
- **Add Component:** adds and connects a component to the graph.
- **Send selected primitive to ZBrush:** open ZBrush with the selected primitive as imported geometry, for more information about this feature click here.

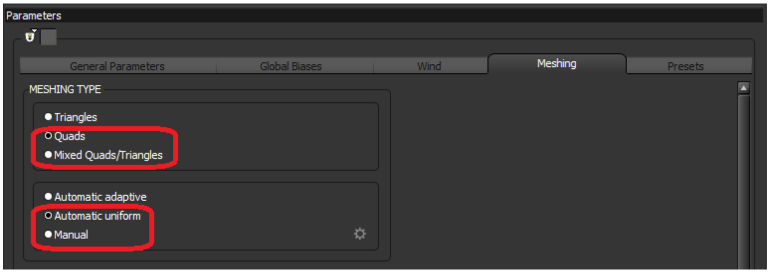
See the Free paint page for more information about drawing mode.

ZBrush Interaction

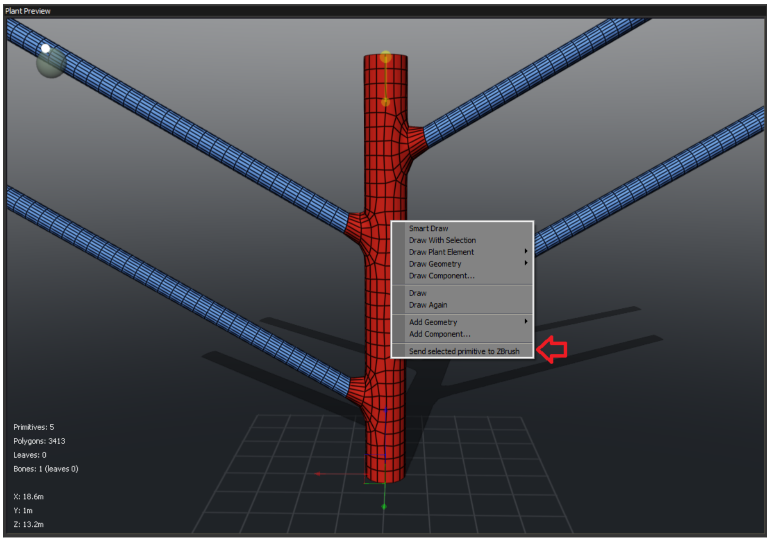
This functionality allows you to sculpt your branch or trunk as you wish in ZBrush and using it in PlantFactory as a part of your plant or tree. It mixes the liberty of a modeler software with the power of generating procedural plants as PlantFactory does.

Studio, Producer...

If you select a mesh of a branch or a trunk in PlantFactory while being in "Touch Up" mode you can send it to ZBrush. It only works if you are in Manual or Automatic uniform mode and Quads or Mixed Quads/Triangles mode.



Meshing to export in ZBrush



Send to ZBrush

In Zbrush, the mesh will have the same subdivision as seen in PlantFactory , you can then edit the geometry by displacing it and/or sculpting it.

It is possible to change the subdivision of the mesh as you like, using the smoothing or not, but beware if you want to export your modification with the current subdivision you need to delete the lower subdivision since ZBrush will only export the lowest subdivision.

...Studio, Producer...

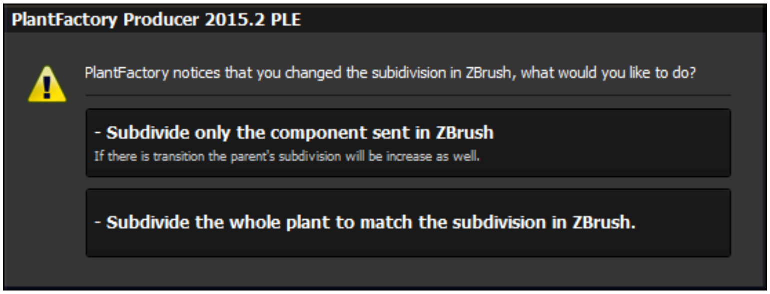
Delete the lower subdivisions

When you have finished with the editing you can send it back to PlantFactory by pressing the GoZ button.

Re-Import button

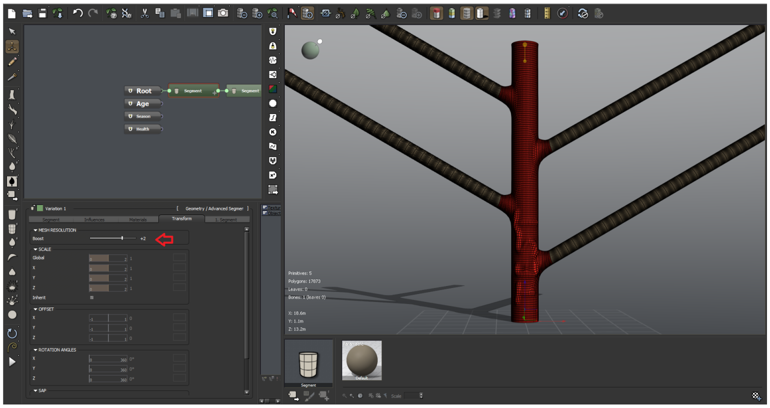
...Studio, Producer...

Back in PlantFactory, if you changed the subdivision in ZBrush, PlantFactory will ask if you want to subdivide the whole plant or only the mesh sent in order to match the subdivision in ZBrush. It will either change the mesh boost of the mesh sent in ZBrush or the subdivision of the whole plant like the "Subdivide more" button would do.



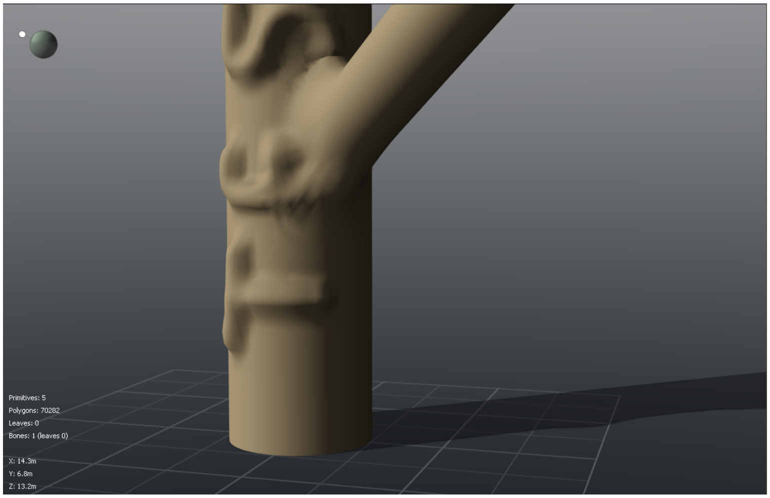
Message when subdivision changed

...Studio, Producer



Mesh boost in case of a subdivision in ZBrush

Notice that if the displacement made in ZBrush cross a transition, the displacement will gently blend into the transition.



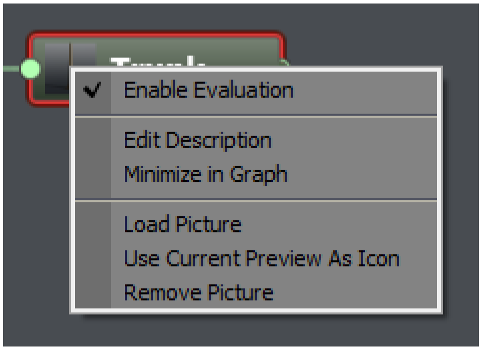
Blending on transition

You still can change the subdivision of the mesh or the whole plant in PlantFactory, the displacement from ZBrush will adapt itself to the selected subdivision.

The branch still has its node properties, meaning that you can change its length, radius, position, section, axis, children properties ...

If you are not completely satisfied with the displacement made in ZBrush you can send once again the mesh in ZBrush following the same steps as the first time.

Node Customization



Contextual menu for editing a node

It is possible to customize and to edit nodes using this menu.

The options for every node are :

- **Edit description:** change the description of the node, visible in the tooltip.
- **Minimize in Graph:** reduce the size of a node to the size of their icon/capture.

The specific options for vegetation node are :

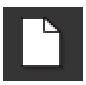
- **Enable Evaluation:** when this option is unchecked, disable evaluation of the selected node.
- **Load picture:** change the icon of the node according the loaded file.
- **Capture view:** capture a screenshot of the preview window and replace the icon by the capture.
- **Remove picture:** remove the picture and put the default picture.

Toolbars

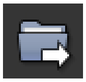
File Export

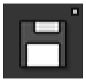
File/Export Toolbar

This toolbar contains the following icons:

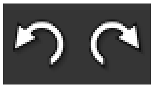
- 

  New: click to create a new file

- 

  Open: click to open an existing file (.tpfp or .tpfs) (see TPF File Formats)
- 

  Save/Save As: left-click to save, right-click to save as (.tpfp or .tpfs) (see TPF File Formats)
- 

  Export Plant: click to open the Export Options dialog
- 

  Undo and Redo: click to undo or redo a previous action

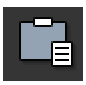
Clipboard

Clipboard Toolbar

This toolbar contains the following icons:

- 

  Cut: click to cut the selected item
- 

  Copy: click to copy the selected item
- 

  Paste: click to paste the selected item

Sub-graph tools

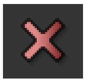
Sub-graph tools Toolbar

Note : this toolbar will only be available when editing a function.

This toolbar contains the following icons:

- 

  Close Sub-graph: closes the sub-graph and saves the changes

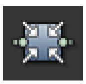
- 

  Cancel Sub-graph: cancels the changes and closes the sub-graph

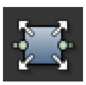
Group Ungroup Nodes

Group/Ungroup nodes Toolbar

This toolbar contains the following icons:

- 

  Group: click to group the selected items

- 

  Ungroup: click to ungroup the selected group of items

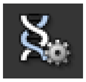
Plant Settings

Plant Settings Toolbar

The Plant Toolbar contains the following icons:

- 

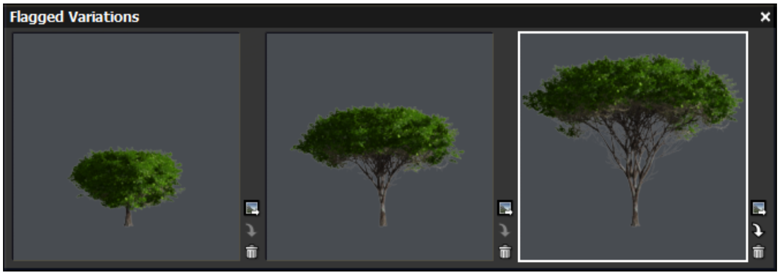
  New Plant Variation: with a plant loaded in the interface, click to create a new variation
- 

  Flag this Plant / Edit Flagged Variations: left click to flag the current variation. right click to open the Flagged Variation dialog.
- 

  Go to Plant Root: click to highlight the plant root and display the Global Plant Parameters

Flagged Variations

Flagged Variations dialog lists all flagged variations of the selected preset.



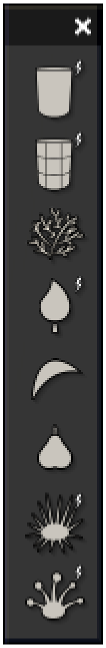
Flagged Variations dialog

A variation can be selected by clicking on its preview.

- click on **picture** button to load a custom preview
- click on **store** button to update the selected variation preview with a screen shot of the Preview Window
- click on **trash** button to delete the selected variation

Designer, Studio, Producer

Geometry Nodes



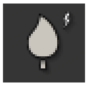
Geometry Nodes Toolbar

- 

  Simple Segment: Generates cylindrical geometry and places child primitive instances around it. This type of segment is good for creating lots of small branches with little memory impact.

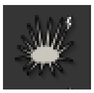
- 

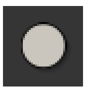
  Advanced Segment: This is the most complex and frequently used node. It can be used to create branches, roots, fruits, leaves, petals...
- 

  AutoGrowth: Generate a plant or a part of a plant using a growth simulation inspired from biologic models
- 

  Leaf: Generates a flat rectangular shape. It is very useful to represent leaves for light tree creation.
- 

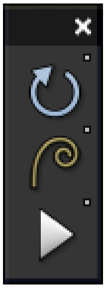
  Warpboard: Generates paraboloid-shaped geometry. Mainly used to create simple leaves or petals.
- 

  Object: Includes the geometry of an external mesh object in the plant.
- 

  Urchin: Generates spherical geometry and places child primitive instances around it.
- 

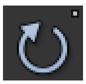
  Ball: Generates a spherical geometry.

Advanced Geometry Nodes

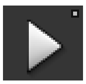


Advanced Geometry Nodes Toolbar

- **Left-click:** on an icon to add a new node like the last node of the corresponding category to the graph
- **Right-click:** on an icon to select a node type belonging to this category from a menu and add a new node with this type

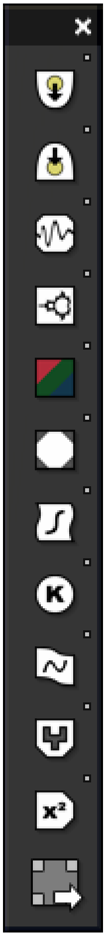
- 

  Loop: adds a loop node
- 

  Spline: adds a spline node
- 

  Misc: adds a miscellaneous node

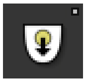
Control Nodes



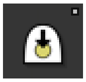
Control Nodes Toolbar

- **Left-click:** on an icon to add a new node like the last node of the corresponding category to the graph
- **Right-click:** on an icon to select a node type belonging to this category from a menu and add a new node with this type

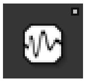
This toolbar contains the following icons:

- 

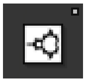
Input: create an input node for the selected component

- 

  Output: click to create an output node

- 

  Noise: a noise node outputs a number between -1 and 1. If a fractal node is selected, it will be converted to a noise node of the same base noise as the fractal.

- 

  Fractal: a fractal node is based on a noise that is repeated at several different frequencies in order to create much more elaborate patterns as the standard noise node. Fractal nodes create patterns that exhibit details over a large range of frequencies. If a noise node is selected at the time of clicking this icon, it will be replaced by a Simple Fractal node based on the same noise as the noise node.

Cyclic Noise and Fractal: with these nodes, a single pattern will repeat itself periodically along all axes (3D space for 3D functions, and also along time for 4D functions) instead of an ever varying pattern repeating over the mapped space.

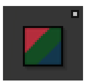
The advantage of these nodes is that there is no seam between adjacent repetitions of the pattern.

Cyclic noises and fractals are located in a sub-menu of the standard noises and fractals. All parameters are exactly the same as those in the corresponding non-cyclic flavor of the noise or fractal. For technical reasons, not all noises and fractals have a corresponding cyclic version.

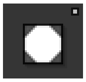
There are additional parameters to specify the repetition period over each of the 3 or 4 axis of the function. The period can be different along each axis, which leads to non-square patterns (but still seamless). The period is expressed as a multiple of the wavelength.

Note:

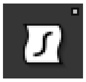
You can also use a cyclic noise in a non-cyclic fractal, but it will lead to results much more predicable than a cyclic fractal, because the periodicity will be the same at each octave, whereas it is not in a cyclic fractal.

- 

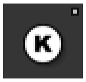
  Color: depending on the context, color nodes either outputs a color based on the value of a number, or converts a color into another color. If a node is selected at the time of clicking this icon, again depending on context, a color node of the appropriate type will usually be added behind the selected node.

- 

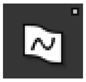
  Texture Map: texture map nodes are used to map pictures (texture maps) onto objects. The texture map node is also created together with a Projection input node. The projection input node converts the current position into mapping coordinates used by the texture map node to map the texture.

- 

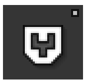
  Filter: filter nodes take a signal as input and output another signal. Clicking repeatedly on the Filter node icon will add as many filter nodes.

- 

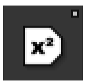
  Constant: if another node was selected at the time of clicking, the selected node will be replaced by a constant node of the appropriate type.

- 

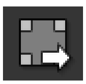
  Turbulence: turbulence nodes take a vector as input, and return a vector. They are usually plugged into the Origin noise parameter, as this is where they will behave as actual turbulence.

- 

  Combiner: combiner nodes are used to combine together different values. Most of them work on all types of data, and output the same type of data as the one provided in input.

- 

  Math: math nodes are used to perform all sorts of operations and conversions between different data types.

- 

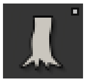
  Load Metanode: metanodes are made up of a combination of nodes that were combined for a desired effect. These can be saved and reused in the plant creation.

Node Presets

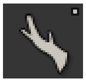
Designer, Studio, Producer...

The Preset nodes Toolbar contains the set of preconfigured nodes making the creation of plants easier.

Node Preset Toolbar

- 

  Trunk: draws (Left-click) or adds (Right-click) a trunk node wich is a preconfigured Segment node that looks like a trunk.

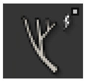
- 

  Branch: draws (Left-click) or adds (Right-click) a branch node wich is a preconfigured Segment node that looks like a branch.

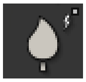
…Designer, Studio, Producer

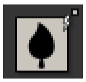
- 

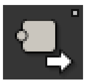
  Stem: draws (Left-click) or adds (Right-click) a stem node wich is a preconfigured Segment node that looks like a stem.
- 

  Palm: draws (Left-click) or adds (Right-click) a palm node wich is a preconfigured Segment node that looks like a palm.
- 

  Twig: adds (Left-click) or draws (Right-click) a twig node wich is a preconfigured Segment node that looks like a twig.
- 

  AutoGrowth: adds (Left-click) a preconfigured AutoGrowth node.
- 

  Leaf: adds (Left-click) or draws (Right-click) a preconfigured Leaf node
- 

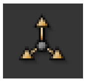
  Billboard leaf: adds (Left-click) or draws (Right-click) a preconfigured Leaf node
- 

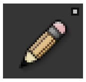
  Component: draws (Left-click) or adds (Right-click) a Component node

Tools

Tools Toolbar

- 

  Select: click to display the parameters for the selected plant node and work in graph mode.
- 

  Touch-up: activates gizmos for resizing and positioning.
- 

  Draw / Draw Once: left-click to draw. Right-click to draw one stroke.
- 

  Prune once / Prune: left-click to prune one area. Right-click to remain in prune mode.

Display Options

The **Display Options** toolbar lets you decide what you want to see or hide in the Preview workspace. These icons are toggles, so you can easily turn these options on and off while you are working.

Note “Subdivide less” and “Subdivide more” are **meshing options** which affects the generated polygons.

- 

  Subdivide Less: Generate less detail.
- 

  Subdivide More: Generate more detail.

- 

  Zoom On Selection/Entire Plant: makes the selected primitives fit the preview viewport, or the whole plant if nothing is selected.
- 

  Wind Preview: Previews wind effects.
- 

  Show information: Displays polygon and billboard count and plant size in scene.

Advanced Display Options

The **Advanced Display Options** toolbar lets you decide what you want to see or hide in the Preview workspace. These icons are toggles, so you can easily turn these options on and off while you are working.

- 

  Hide Geometry: Hides the geometry of the selected primitives.
- 

  Hide Branches: Hides the bodies of all segments in the plant preview.
- 

  Hide Billboards: Hides all billboards in the plant preview.
- 

  Hide Blades: Hides the blades of all segments as well as all warpboards in the plant preview.

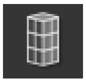
- 

  Hide Objects: Hides all objects in the plant preview.
- 

  Show Less: Removes hierarchically lower parts of the plant.
- 

  Show More: Clicking on this icon brings parts back that were removed.
- 

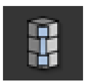
  Highlight Selection: Highlights the selected node on the plant so you can see the correspondence of the node to the plant.
- 

  Show Node Color on Plants: Shows the selected plant part in the same color as the corresponding node.
- 

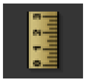
  Show Wireframe: Displays the plant in wireframe.
- 

  Display Shadows: Shows plant shadow.
- 

  Preview displacement: Allows for material displacement preview.
- 

  Show Normals: Displays normals.
- 

Show Export Rig: If plant has rigging, displays this rigging.

- 

  Show Ruler: Shows the ruler for scale checking.

- 

  Show Bias Controls: Shows bias controls for editing.

- 

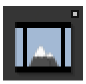
  Disable Automatic Updating of Preview: Hinders the preview while this option is set.

- 

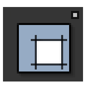
  Hide Discarded Transitions on Plant: Hide the transitions that are not possible due to space limitation on a plant.

Render

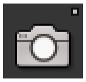
Render Toolbar

- 

  Render Stack / Save color picture: left-click to open the Render Display dialog; right-click to save the current render.

- 

  Select Render Area: left-click to enable/disable the render area; right-click to select a new render area.

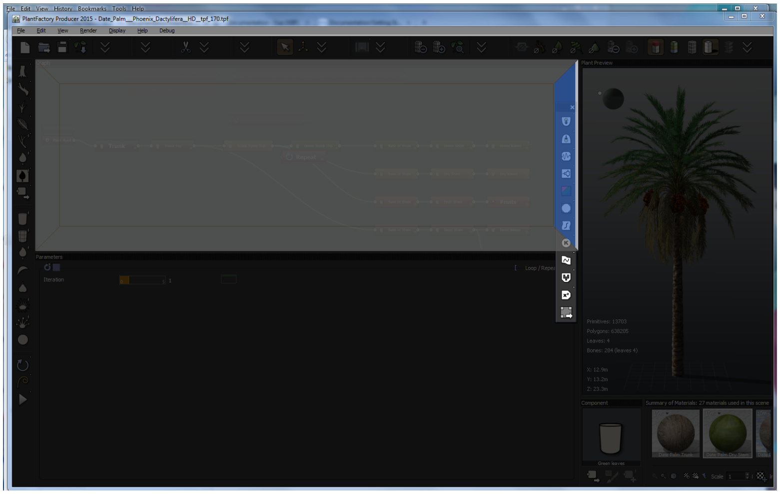
- 

  Render / Render Options: left-click to render the scene using the settings as they currently exist in the Render Options dialog. To change the render settings, right-click to display the Render Options dialog.

Docking

Toolbars and dockable dialogs may be rearranged at will in the Main Window. You can tell if a dialog is dockable by just moving it in the interface. If it is dockable, available docking areas will show in the interface. Freely floating windows can be moved by left-clicking on their **upper bar** and dragging. While dragging, trapezoids show up in the other windows. You can dock anywhere within the trapezoid. Moving the window and dropping it on such a trapezoid will dock it there.

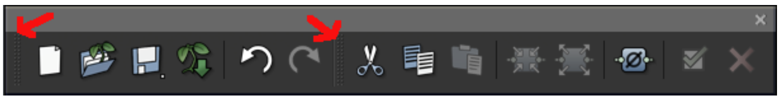
Trapezoids sometimes have a gradient of lighter borders that allow you to dock along side a group of areas. The nearer the border the bigger the group.



Docking Node Options Toolbar to New/Load/Save Toolbar

Undocking

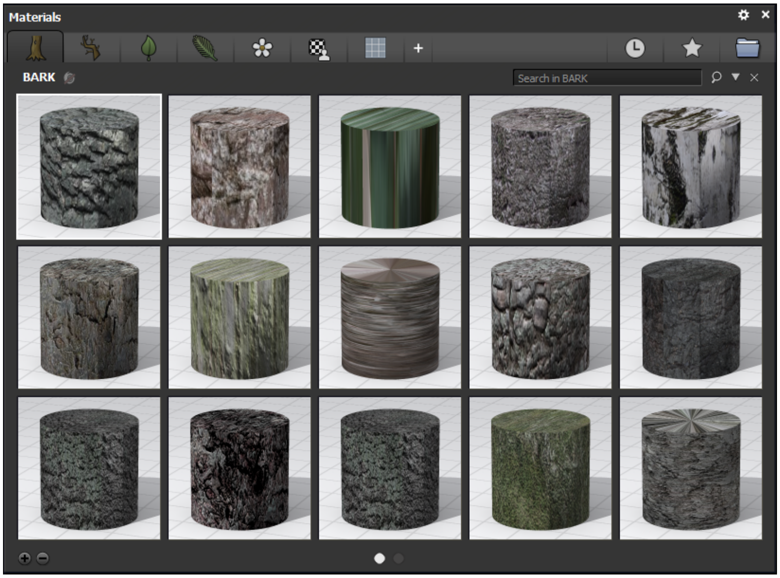
Windows that are already docked have a **grip bar** on their left or top edge. Left-click on the grip and drag it to undock the window.



Grips for undocking

If you are satisfied with your current window organization, you can lock it using the **Lock Workspace** command of the Window menu. In this menu you can load basic and advanced docking presets as well. Docking configuration is preserved from one TPF session to another.

Visual Browsers



Visual Browser

Whenever you need to select a file, PlantFactory will display a Visual Browser to help you make your selection.

The Visual Browser lets you select files using preview pictures instead of filenames. Clicking on one of the preview pictures will display it full size at the top left of the browser, along with the title of the file and a short text description.

Underneath the text description, you will also notice, written in gray, the name of the file. This is useful when you want to delete a file, or move it to another folder.

The item that is currently displayed at the top of the browser is framed in black in the list of available items. If you press **OK**, this is the item that will be loaded. To select an item, simply click on it. Double-clicking on an item closes the browser and loads that item.

You can delete items in the list by highlighting them and hitting the **Delete** key. A prompt will appear asking if you want to delete the item completely (i.e. delete the file from your hard drive) or if you just want to hide the item from the collection.

Visual Browsers are non modal, so that you can leave them open and drag content from the browser into the scene anytime.

Collections

Inside the Visual Browser, items are organized in collections, a list of which is displayed on the left side. The items that are currently displayed belong to the highlighted collection. To display the items from another collection, simply click on the desired collection in the list.

Collections are in fact shortcuts to directories containing items of the requested type. You may add as many collections to the list as you like by creating new folders in the root folder of the type of item displayed by the Visual Browser (e.g. Materials folder for Material Browser) or by clicking the **New Collection** button at the end of the list and browsing to the folder location (a Standard File Browser will appear). Browse to the new collection's folder, and select the desired folder. You will be prompted for a name. This is the name the collection will have inside the Visual Browser. Click **OK**, and wait for a couple of seconds while TPF builds the item previews and displays them).

If you add files to a folder that is listed by a Visual Browser as being a collection, the corresponding new items will automatically be added to the previews.

Collections may be removed from the list by clicking the **Delete Collection** button. A prompt asks you to confirm the withdrawal of the currently highlighted collection. Please note that removing a collection does not delete any actual files from your hard disk.

You can reorganize your collections by dragging and dropping them at a new location. A line appears as you drag a collection to show you where the collection will be placed if you drop it. Some collections exhibit a small symbol in front of them to indicate that the collection is a group collection and that it contains other collections. By clicking on this symbol, you will display the other collections inside that collection group.

If you would like to convert an existing collection into a group of collections, drag and drop another collection onto it with the **Control** key pressed. The collection you dropped onto will become a group collection, and the collection that was dropped will be placed in that group collection.

When a group collection is selected, it shows the sub-collections in the list of available items, identified by a folder icon.

You can rename a collection by clicking twice on it. An edit field appears letting you enter the new name. Hit **Enter** to confirm the new name, or click outside of the edit field to cancel the changes.

You can lock the browser collection by clicking on the **Lock** icon (under the collection list). This prevents any organization or changes (renaming, deleting or dragging) to the displayed collection. It can always be unlocked if changes need to be made.

Loading other Files

If the file you wish to load is not displayed in any of the available collections, you may access it directly by clicking the **Browse File** button. A Standard File Browser will appear, letting you browse and select your file.

Virtual Collections

Some collections have a slightly different behavior, because files from these collections are not necessarily available on your hard drive. These collections are known as Virtual.

The whole purpose of Virtual Collections is to offer you a large selection of files, without requiring massive amounts of hard drive space.

When you select a file from a Virtual Collection, a following pictogram appears in the preview. This means that the file you have selected was not physically copied to your hard drive at the time of installation. Instead, a reference was created to this file on one of the product's CDs.

If you load the file, a dialog box will appear instructing you to insert a given CD. Simply insert the CD in your CD ROM drive and press **OK**.

If you don't want to have to fetch the CD next time you use that file, select the option **Copy the file to my Hard Disk**. When you press **OK**, the file will be first copied to your hard drive, and then loaded into the program. Next time you select this file in the collection, you will notice that the pictogram has disappeared from this file's preview.

You can also decide to copy all the files from the collection to your hard drive by checking the option **Copy all files in this collection to my Hard Disk**. When you press **OK**, all the files in the collection will be physically copied to your hard drive, and the collection will no longer be virtual.

If you don't want to use files in this collection any more, press the **Remove collection** button.

If you have to locate the file manually, press the **Locate file manually** button. A Standard File Browser will appear letting you browse to the location of the selected file.

Section 3

Creating Plants: Painting and Components

In PlantFactory, you can create plants by two methods of painting.

- You can free paint, which starts by painting a trunk, or stems, and adding the additional parts of the plant by painting them in.
- You can select parts of plants and paint using these defined parts of plants to create a new plant. This is called **Component Painting**.

Painting is part of the **Manual Mode** of plant creation. In **Manual Mode** you paint, and you can also prune and touch-up segments and other primitive instances with your mouse. You can select an individual primitive instance and adjust some of its parameters as well.

Manual Mode is very handy to tweak almost finished plants. But unfortunately many plant species, especially trees, are composed of too many branches for the user to paint each one of them individually from scratch. For modeling of such complex plants a procedural approach is needed. Please remember that **Manual Edition** should come last in the plant creation process! Altering global node parameters (**Procedural Edition**) after having tweaked these parameters in case of particular primitives (manual edition) can yield surprisingly unexpected results!

Free Paint

Free Paint

Entering Painting Mode

In Manual Edition Mode, you can enter Painting Mode either by left-clicking on the **Paint once** icon in the Tools toolbar or with the **Edit > Active Tool** menu command. It is also possible to choose between multiple drawing options by doing a right click in the preview, it will show the draw menu.

Hovering with the mouse over the Preview window will display a small green line that shows where the painting will take place and the mouse cursor will look like a brush. You can either paint on the ground or on the plant.

Brush Selection

This section is about what kind of nodes are going to be painted. The algorithm selects a node and generates primitive instances from this node and its children.

- By default the painting mode is **automatic**, which means that TPF tries not to modify the graph structure but rather create additional primitive instances using the existing set of nodes:
  - If you were painting on the ground, the first node connected to the Plant root will be selected for primitive instance generation. *This will thus create another instance of the plant starting from where you clicked on the ground.*
  - If you were painting on the plant, TPF will look at the node N associated to the primitive instance you clicked on.
    * If N is not a multiplier node, painting will fail. *This is the case when trying to paint a leaf on another leaf; it is impossible because there is no connection. So you should start painting from segments and urchins.*
    * If N has children, the painted primitive instance will be generated from N's first child node. *This will paint vegetation like what already exists, starting from where you first dragged.*
    * If N has no children, a copy of N will be created in the graph and connected as output to N. *For example painting on a dead branch without leaves will create a child segment looking like the dead branch.*
- It is also possible to choose what kind of vegetation should be painted by using components. With the **Add component** option, you can select a component to draw and click on the **Painting mode** icon on the left. (Note that you can also

select nodes or components from the graph or libraries by browsing with the buttons of the upper bar.) Using components for painting will enrich the plant graph.

Drawing the Spline

To start painting, **left-click** on the desired location in the preview window and keep the mouse button down while **dragging** the mouse to draw a spline.

- If painting a segment, its axis will follow the spline.
- For other types of nodes, nothing like an axis exists (think about leaves). Painting will thus just create an extra primitive instance at the starting position.

Since painting occurs within the 2D plane orthogonal to camera axis, it may be a good idea to rotate the plant preview before painting.

After releasing the mouse button, the spline shape is baked inside the plant and you are reversed out of painting mode. To avoid that and paint several times in a row, right-clicking on the icon or select the **Paint** menu to enter painting mode. You will stay in painting mode as long as you do not select another Manual edition mode.

Touch Up

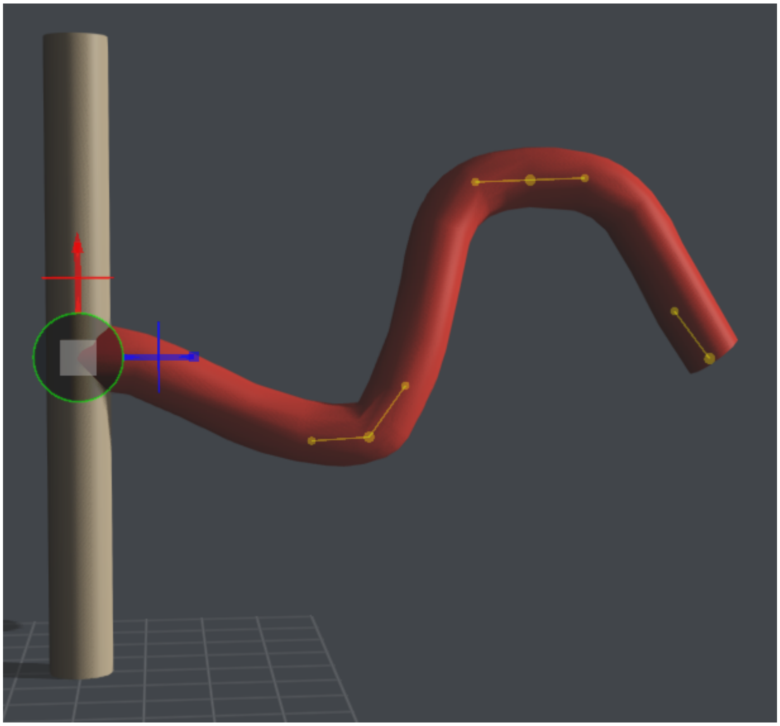
Touch-up is a Manual edition mode feature to edit **size, shape and orientation** of primitive instances, mainly segments, and the whole plant as well. Entering touch-up mode is done through the **Touch-up** button of the Tools toolbar or the **Edit > Active Tool** menu command. A primitive instance, a node or the whole plant must be selected for Touch-up mode to be useful.

Touch-up features **spline points** and **tangents manipulation** for all segments. Since touch-up actions work with the way primitive instances are placed with respect to their parent, some actions can be only performed if the currently selected primitive instance has a parent.

Touch-up effect is dependent on selection type:

- for whole plant selection, Root Touch-Up applies;
- for node selection, all primitive instances derived from this node will be affected;
- for primitive instance selection, only the selected primitive instance will be touched-up.

Segment axis spline manipulation



Axis spline manipulation

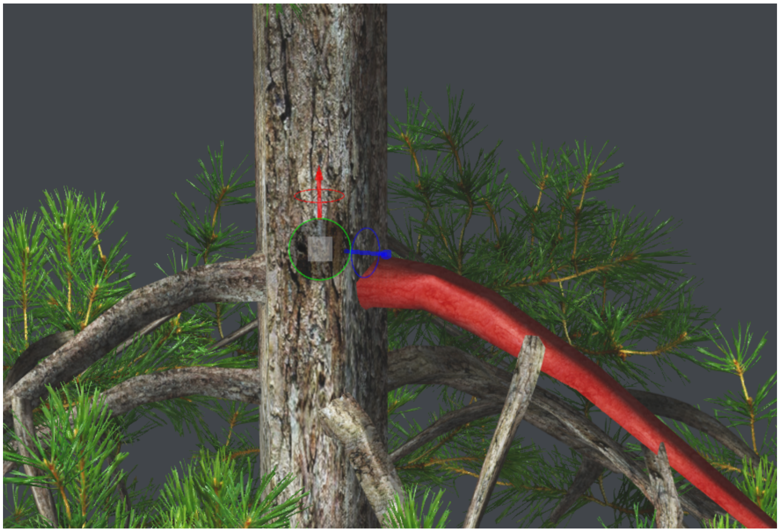
It is possible to control the segment axis with keypoints (green) and tangents (blue). All points can be moved within the 2D plane orthogonal to the camera direction, so rotating the plant preview may be a good idea before starting touch-up.

- **Left-click and drag** a keypoint to **move** it.
- **Left-click and drag** a tangent extremity to **modify the tangent**. Since tangent length represents its influence on the spline, both direction and length can be modified. If you want to edit only half tangent, hold **Ctrl** key down while editing it.
- Hold **Shift** key down and **left-click** anywhere on the primitive instance to create a **new spline control point**.
- **Right-click** on a control point to **delete** it.

Please note that if biases influence the segment the control points will not match the actual segment shape but the uninfluenced axis instead.

Touch-up with parent

If the selected node or primitive instance has a parent, the Vegetation gizmo will be displayed at the junction. On this example the tree main trunk is the parent primitive instance whereas the red branch is the selected child primitive instance.

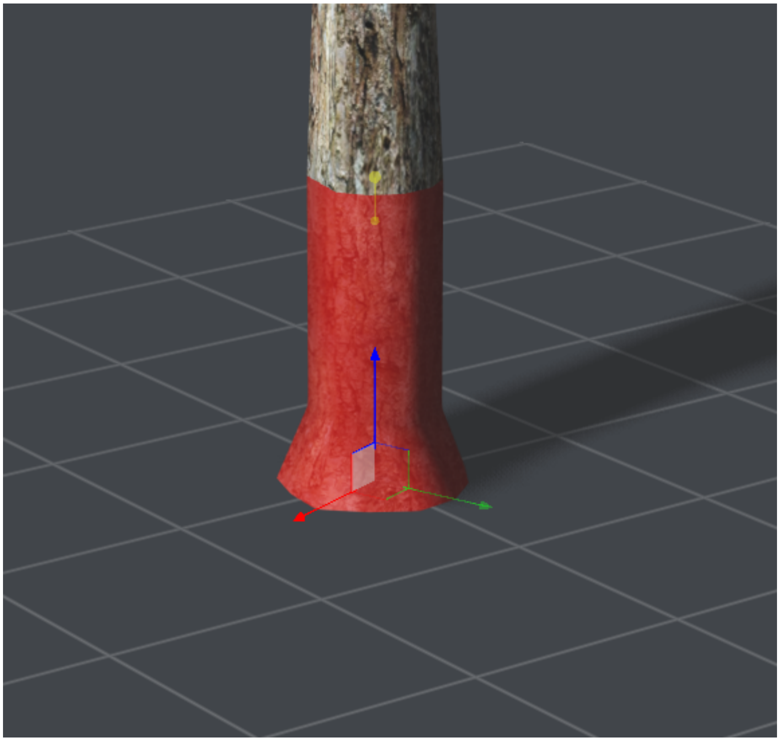


Vegetation gizmo for touch-up with parent

Using the mouse **left-click and drag** on this gizmo the possible actions are:

- **Rotate the green circle** to tilt the child primitive with respect to its parent. This is equivalent to applying an Angle offset to the value in the parent's child tab.
- **Rotate the red circle** to rotate the child primitive around its parent axis. This is equivalent to applying an Roll offset to the value in the parent's child tab.
- **Rotate the blue circle** to roll the child primitive around its own axis. This is equivalent to applying an Rotation offset to the value in the parent's child tab.
- **Move the red arrow** back and forth along the parent axis to move the child primitive. This is equivalent to setting special Start / End that offset the values in the parent's child tab.
- **Move the blue arrow** back and forth along the child axis to increase or decrease the child segment length.
- **Drag the white square** in the top-right or bottom-left direction to increase or decrease the child segment radius.

Touch-up with no parent



Touch-up with no parent

If the selection has no parent, gizmos will be shown and allow to **move, rotate** or **rescale** the selected primitive. Select the right type of gizmo in the **View > Gizmos** menu command. This is equivalent to setting values in the Transform tab of the segment.

Root Touch-up

If the plant was globally selected (**triple-click** on any part of the plant or Plant root node selection in graph), the Touch-up mode allows to globally **move, rotate** or **rescale** the plant by using gizmos analog to the aforementioned. This is equivalent to setting values in the General parameters tab of the Plant root node.

Selection

Selecting parts of the plant can either be done in the Plant Preview window or in the Graph area. Several Manual and Procedural Edition actions require something to be selected first.

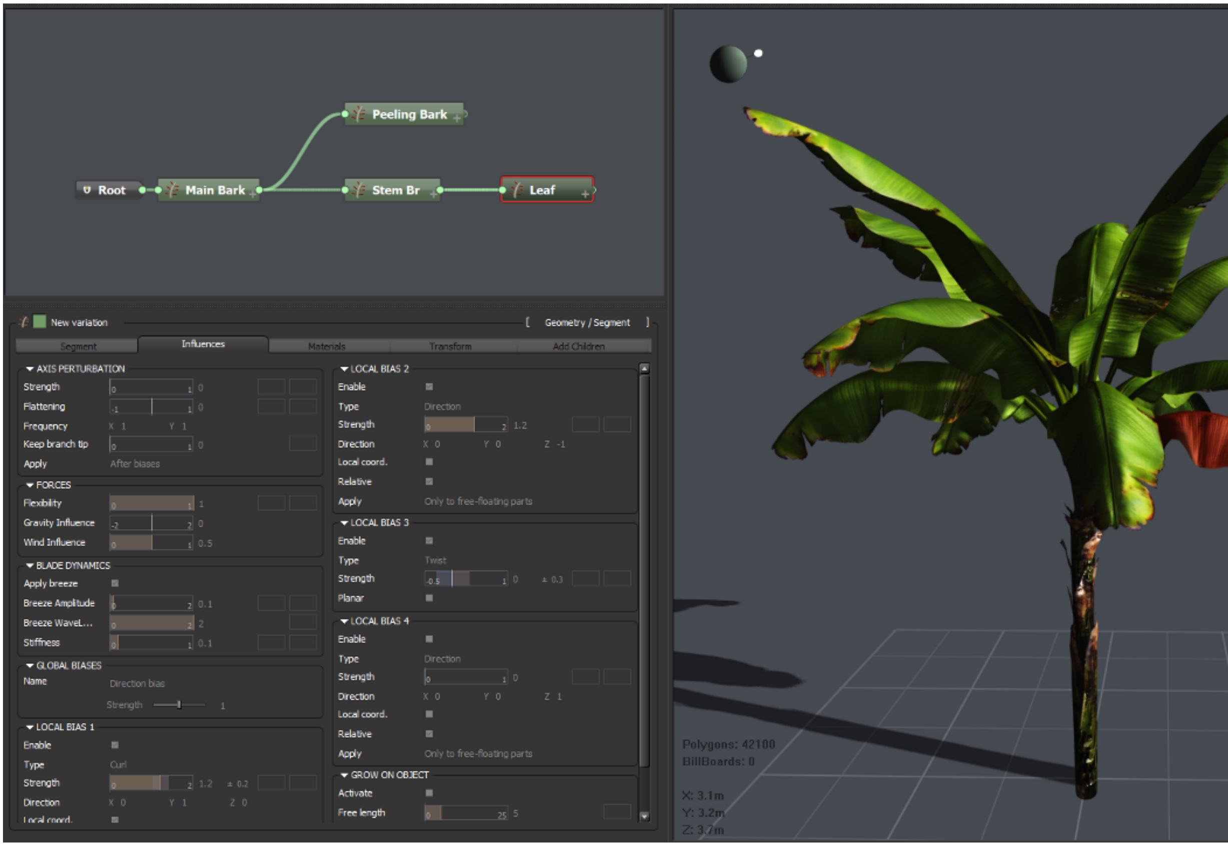
Primitive Instance Selection

Selecting a primitive instance allows to tweak it individually through Manual edition. If the **Highlight Selection** option of the Display Toolbar is on, selecting a primitive instance will highlight only the geometry that belongs to this particular primitive instance in the preview.

To select a primitive instance, activate Touch-Up tool and left-click on the primitive instance in the Plant preview window.

Alternatively, if a primitive instance of a node has already been individually edited, you can select it by selecting the node and then selecting the associated variation of its parameters.

When a primitive instance is selected, its parameters are grayed and it is possible to edit them individually. With Touch-up mode, select a primitive instance to use gizmos and spline edition tools to tweak it graphically as well. All changes made then will only impact the selected primitive instance.



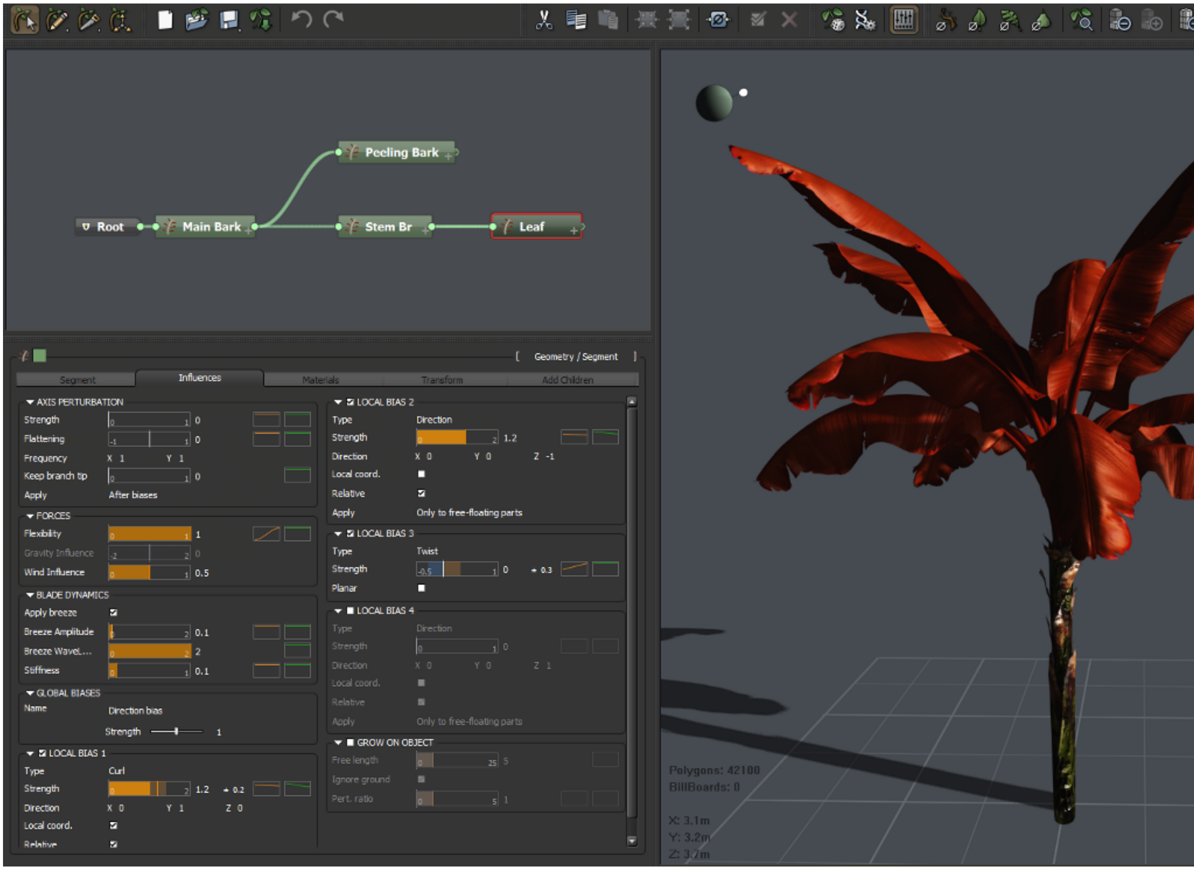
Node Selection

Selecting a node is equivalent to selecting all primitive instances derived from this node. If the **Highlight Selection** option of the Display Toolbar is on, selecting a node will highlight all geometry that was generated from this node in the Preview.

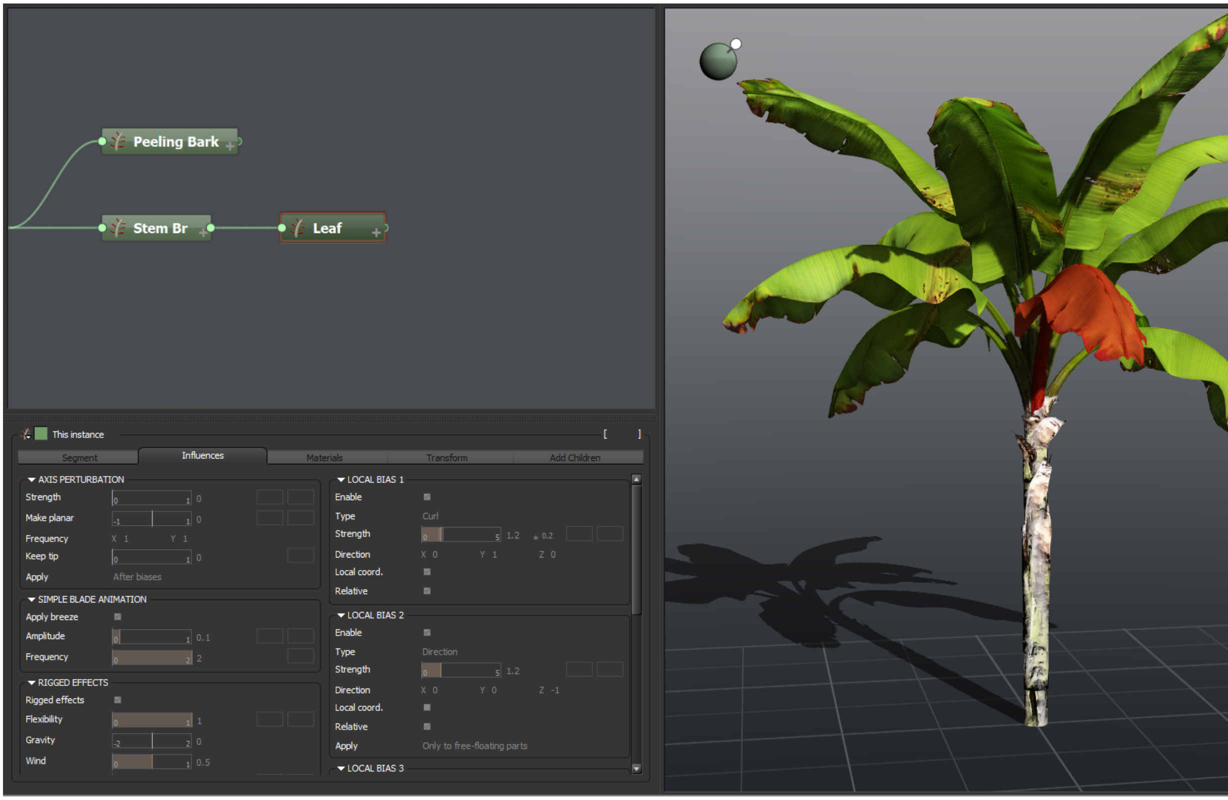
To select a node, either :

- **Left-click** on it in the Graph area ;
- **Left-click** on any primitive instance in the Plant Preview window using the Select tool.

When a node is selected, it is possible to edit its parameters. In Touch-up mode it is also possible to use gizmos and spline points to edit properties of the node and its parent if any. All parameter changes made in **Node Selection mode** will impact all primitive instances that have not been made unique with respect to this parameter.



If only one part of a node is selected the highlight around a node in the graph will be less bright than when a whole node is selected.

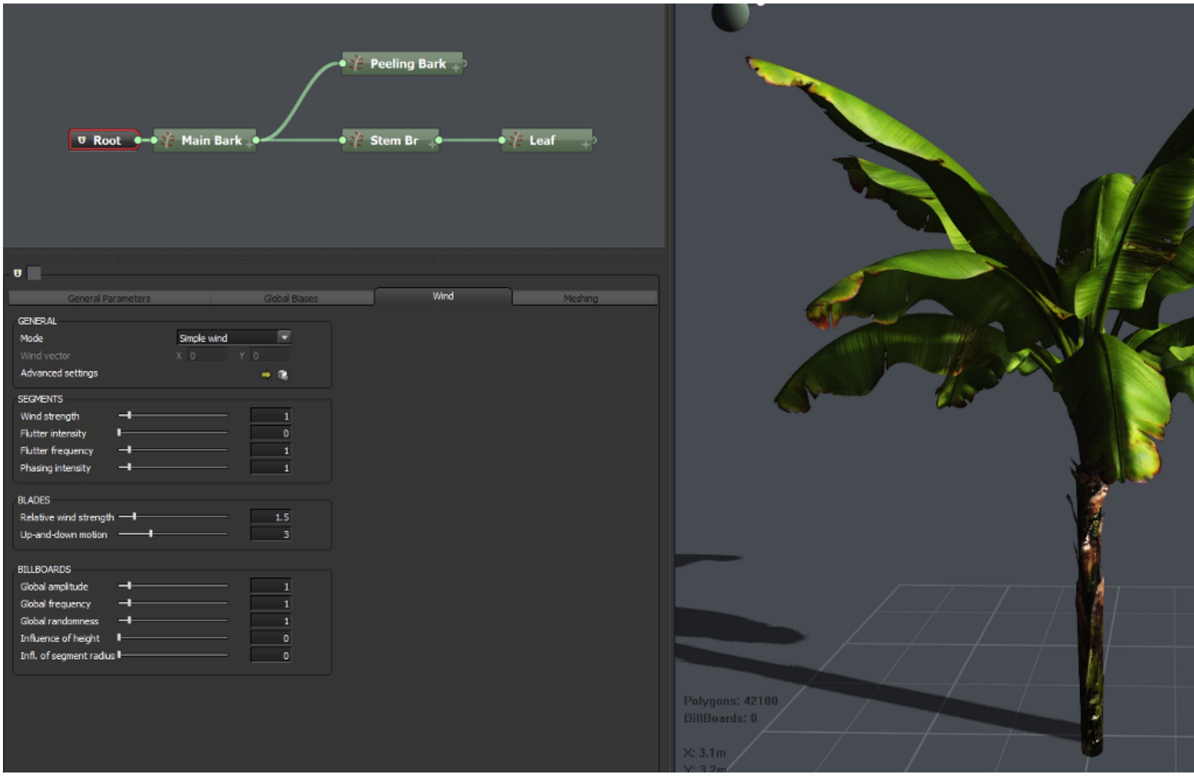


Whole Plant Selection

Global properties of the plant can be edited by selecting the whole plant. Select the entire plant in one of several ways:

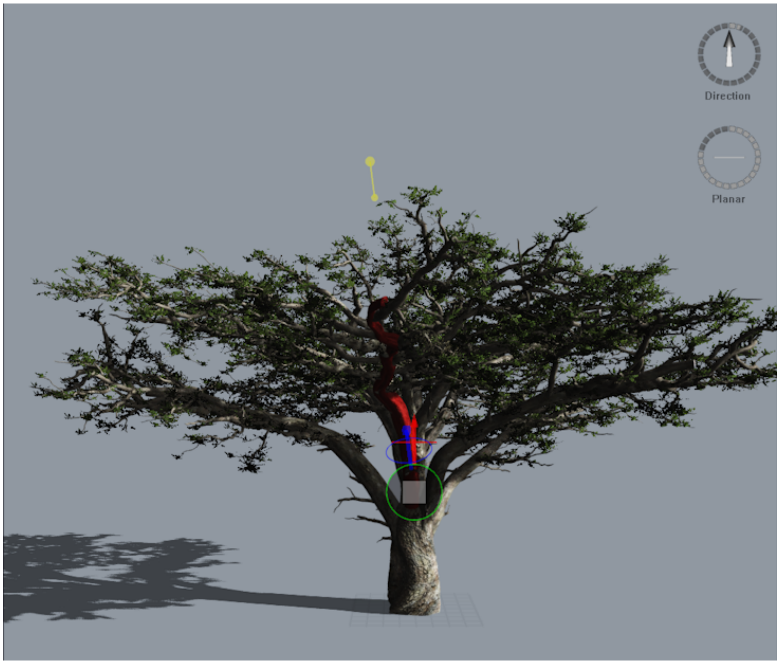
- **Left-click** on the Plant root node in the Graph area ;
- **Double left-click** anywhere on the plant in the Plant Preview window ;
- **Left-click** on the **Go To Plant Root** button of the Plant Toolbar ;
- Select **General Plant Parameters**, **Wind Settings**, **Global Biases** or **Meshing Options** from the **Edit** menu. *This will also select a particular tab in the Parameters window.*

In touch-up mode, by selecting the whole plant, you can configure its 3D properties globally.



Bias Gizmo

If global biases for the plant were defined in the Plant root node, they can be adjusted using gizmos in the Plant preview window.



Bias Controls

Activating Bias Gizmos

To enable bias gizmos you can either :

- left-click on the **Show Bias Controls** icon in the Display toolbar
- use the **View** > **Preview** > **Show Bias Controls** menu command
- left-click on the **Show Bias Controls** button in the global biases tab.

This displays a bias gizmo per existing global bias on the right of the plant preview window (or in the 3D preview in case of an Attractor bias). Add or remove global biases only in the Global Biases tab.

Non-attractor Bias Gizmo

The non-attractor bias gizmo is made of a dashed circle containing a symbol depending on bias type.

- The bright part of the circle represents the strength of the global bias. The larger the bright part, the stronger the bias.
- The symbol is oriented in the direction of the global bias.

It is possible to use the bias gizmo to tweak the global bias as if you were modifying its 'Strength **and** Direction **values in the global biases tab.**

- Left-click on the circle and drag around to modify bias strength.
- Dragging clockwise increases strength, dragging anti-clockwise decreases strength
- It is possible to do several turns. In this case the dashed circle will become more and more bright.
- Left-click on the symbol and rotate by dragging to modify the bias direction.
- This feature is disabled for bias types that have no Direction field like twist.

Attractor Bias Gizmo

Since the Attractor bias works with a position rather than a direction, it has a special bias gizmo that is located at its position in the 3D plant preview. It is symbolized by a black magnet.

- Left-click on the magnet to select it
- Select the **Position** or **Scale** gizmo type from the **View > Gizmos** menu
- Position to move the gizmo and change direction vector in the global biases tab (this modifies the attractor position)
- Scale to change bias strength.
- Move or scale the magnet gizmo according to your needs.

Individual Edition

Sometimes manual edition using graphical tools like gizmos in the plant preview doesn't bring in enough tweak possibilities for plant finalization. Graphical edition is actually limited to a small number of parameters like primitive instance positioning in space and other geometrical informations like length and radius.

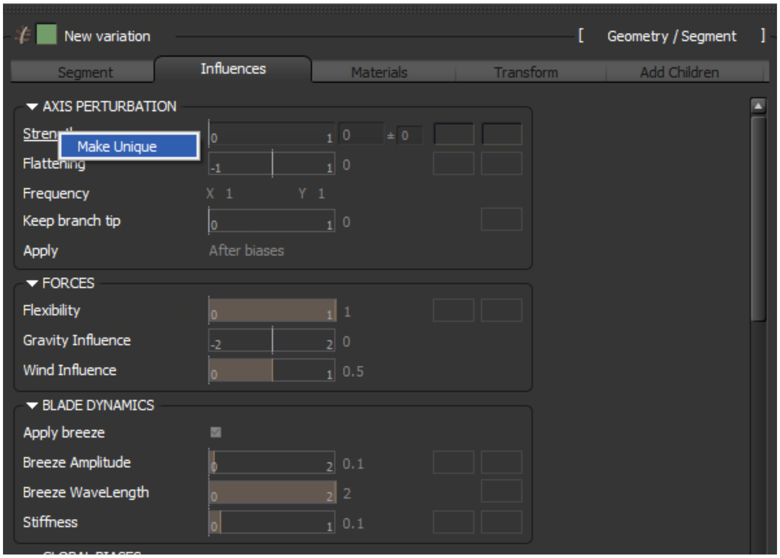
However nodes have so many more parameters that you would maybe like to adjust on an individual primitive instance basis. That's the reason why individual edition exists. In **Individual edition** mode, the node parameters can be tweaked for each primitive instance individually.

Please select the particular primitive instance you want to edit individually (**simple left-click** it in the plant preview) before going on.

Making Parameters Unique

All parameters should be grayed at this time. To access the parameter you want to edit, left-click on its name to make a pop-up menu with **Make Unique** appear. Clicking **Make Unique** will create a variation associated to this primitive instance and tell TPF that for this particular primitive instance, the default value of the parameter contained in the node is overridden by the variation.

Since now the unique parameter is not grayed anymore, you may edit it and adjust it to whatever you like.

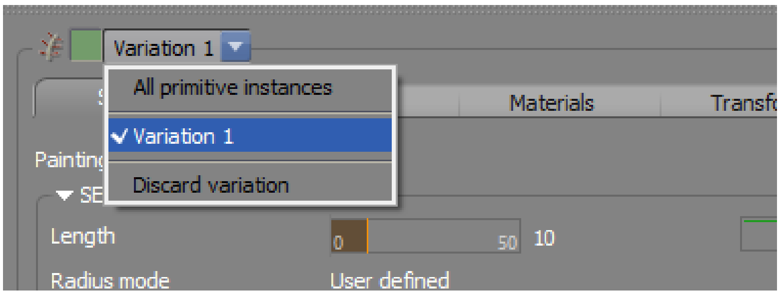


Making a Parameter Unique

Conversely, you can cancel making the parameter unique by left-clicking on its name to call the pop-up menu and selecting **Revert**. This will mean the parameter value is no longer overridden for this particular primitive instance. The general parameter value for the node applies and the parameter is grayed again.

Variations

All existing variations for the currently selected node are listed on the top of the parameters window.



Variations

On this menu you can select the variation to display and discard a variation as well.

- **All primitive instances:** displays the general parameters set applicable to all primitive instances not associated to any variation.
- **Variation 1, 2...:** displays the parameters set associated to the selected variation and selects the associated primitive instance. Only made unique parameters will not be grayed. More parameters can be made unique by using the popup menu (see above).
- **Discard variation:** removes the selected variation, causing the associated primitive instance to be generated with the node general parameters set again.

Segment Pruning

In Manual Edition Mode, a segment pruning tool is available from the Tools toolbar.

Left-click on the **Prune** icon to enter **Pruning mode**. The mouse cursor now has the form of an eraser and hovering the mouse over a plant segment in the Preview window will make a small green line appear.

If you left-click at that position, the segment will be pruned there.

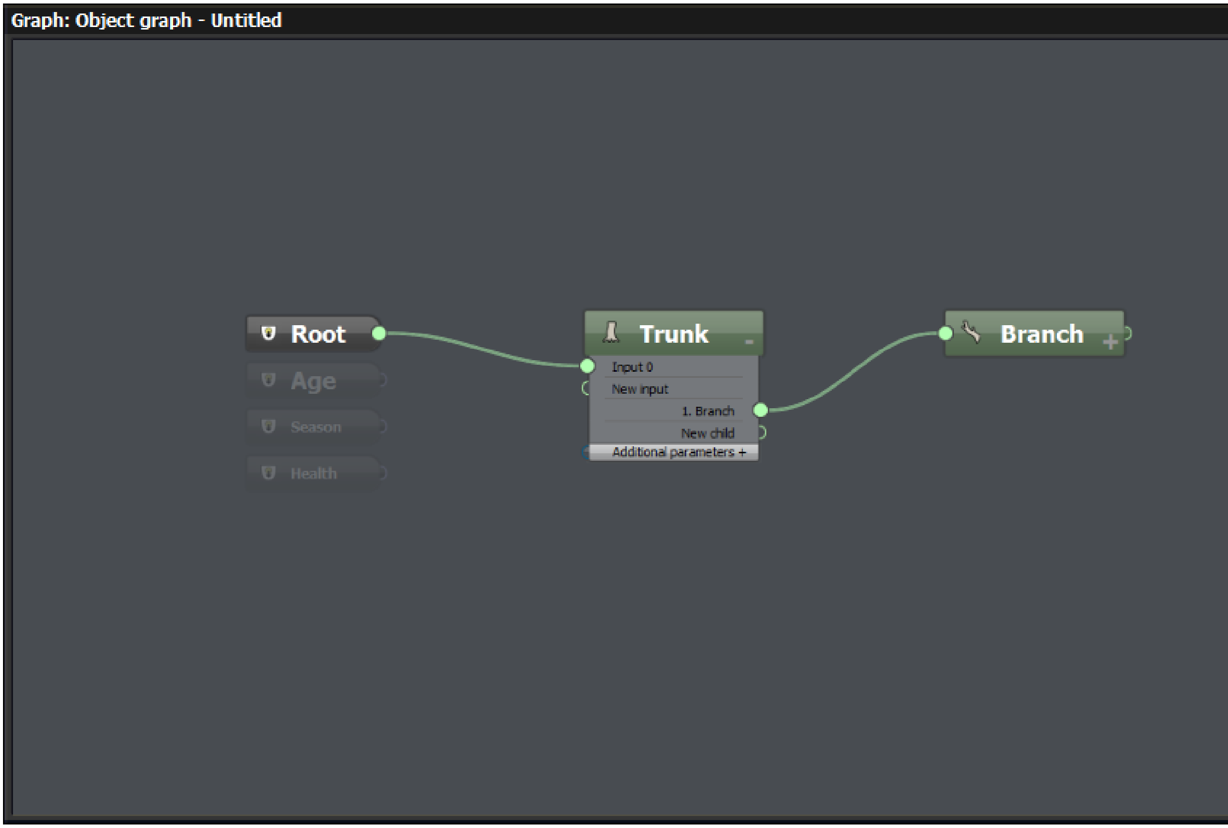
Note that after pruning, TPF reverts into Touch-up mode. To prevent this, right-click on the **Prune** icon instead of left-clicking and you will be able to prune as many segments as you wish without being reversed in another edition mode.

Section 4

Creating Plants: Using the Graph

In the Graph Window, the plant is described through a graph of nodes. Procedural modeling is what helps us with the huge complexity of many plants. Instead of manually defining the position and shape of each branch, you can just define a set of rules using nodes to be used by PlantFactory to create the plant geometry.

The advantage of procedural modeling is that it keeps just a small formula which is then used to generate very complex shapes. And with some variability defined, it creates almost an infinite number of variations from just one such set of rules. Nodes can be renamed to reflect plant parts to make them more meaningful.



When PlantFactory starts, there are usually nodes for Root, Age, Season and Health displayed. One segment, representing a tree trunk, is also displayed. These are the program defaults.

Nodes can be renamed to be more meaningful.

Graph Edition

Studio, Producer

Plants can be constructed by working directly in the graph viewport by adding nodes, connecting them and setting parameters in the Parameter viewport.

There are several ways to add nodes into a graph:

- by using the Node Presets toolbar or the Geometry Nodes toolbar.
- by using the Nodes Selector.
- by clicking on the graph window and selecting a node to add.
- by selecting **Add to graph** in the Component dialog.

Nodes can also be added automatically by using the **Add children tab** in the Parameter viewport of Segment node.

Multi parameters can be used to edit parameters of several nodes at the same time. Select several nodes. Parameters of the first selected node displays. Edit one parameter:value of this parameter will be applied on all selected nodes (if selected node has the same parameter.

Functions can be selected to further modify the characteristics of the various nodes.

In the Graph viewport, you can pan the window (right-click and move the mouse), to see parts of a large graph that can't be displayed all at once, and zoom (ctrl + right-click and move the mouse) to make parts of the graph larger or smaller.

Graph Edition

Artist, Designer

Nodes on the graph are created by loading a plant or creating a plant by painting. If you delete or change any of the plant parts by deleting parts in the Preview window or changing the parameters, the corresponding nodes will be deleted.

Click on the various nodes to display the parameters for that node for editing.

Nodes cannot be directly added or manipulated in the graph.

Node List

Vegetation Nodes

Geometry Nodes

Geometry nodes can be used to generate a surface, arrange child primitives, or both.

Here is the complete list of the geometry nodes:

Surface Nodes

These nodes generate a geometric shape with a surface when they are evaluated in the graph.

- **Segment:** Generates cylindrical geometry and places child primitive instances around it. This is the most complex and frequently used node. It can be used to create branches, roots, fruits, leaves, petals...
- **AutoGrowth:** Generates complex geometry using a growth simulation inspired from biologic models. The simulation depends on parameters such as age, shadow sensitivity, apical preference, decay, cuts...
- **Leaf:** Generates a flat rectangular shape. It is very useful to represent leaves for light tree creation.
- **Object:** Includes the geometry of an external mesh object in the plant.
- **Warpboard:** Generates paraboloid-shaped geometry. Mainly used to create simple leaves or petals.
- **Urchin:** Generates spherical geometry and places child primitive instances around it.
- **Ball:** Generates a spherical geometry.

Multiplier nodes

Multiplier nodes can have output nodes linked to them, meaning that child primitives hierarchically lower will be generated. Multiplier nodes allow to configure the number and characteristics of such child primitives.

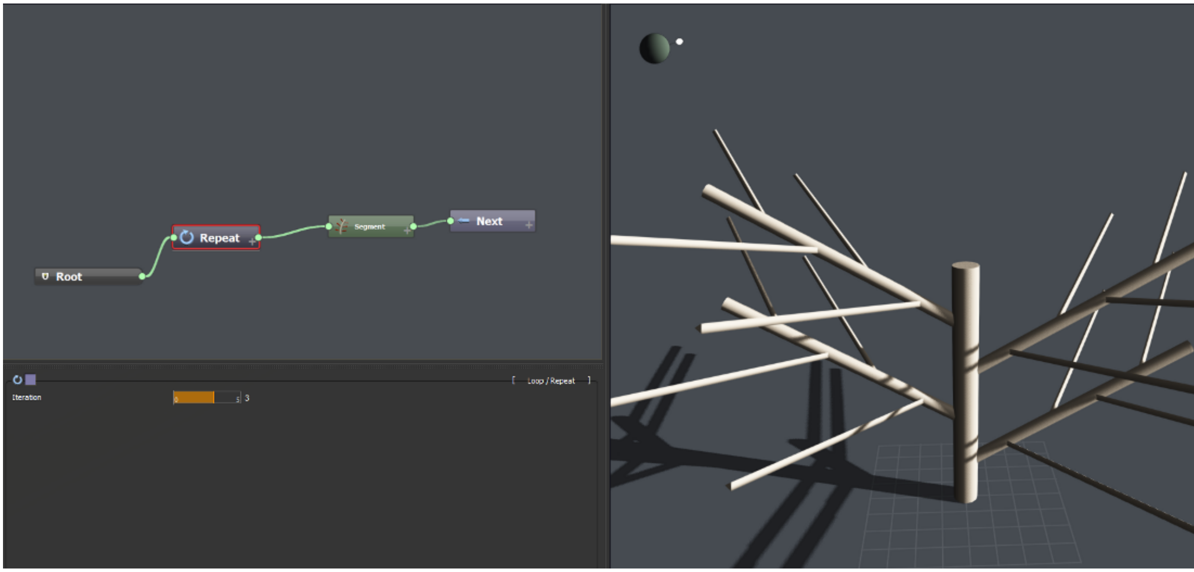
- **Hydra:** Does not generate its own geometry but instantiates several child primitive instances, spreading them along a circle.

Note:

Segment and Urchin are multiplier nodes as well as surface nodes.

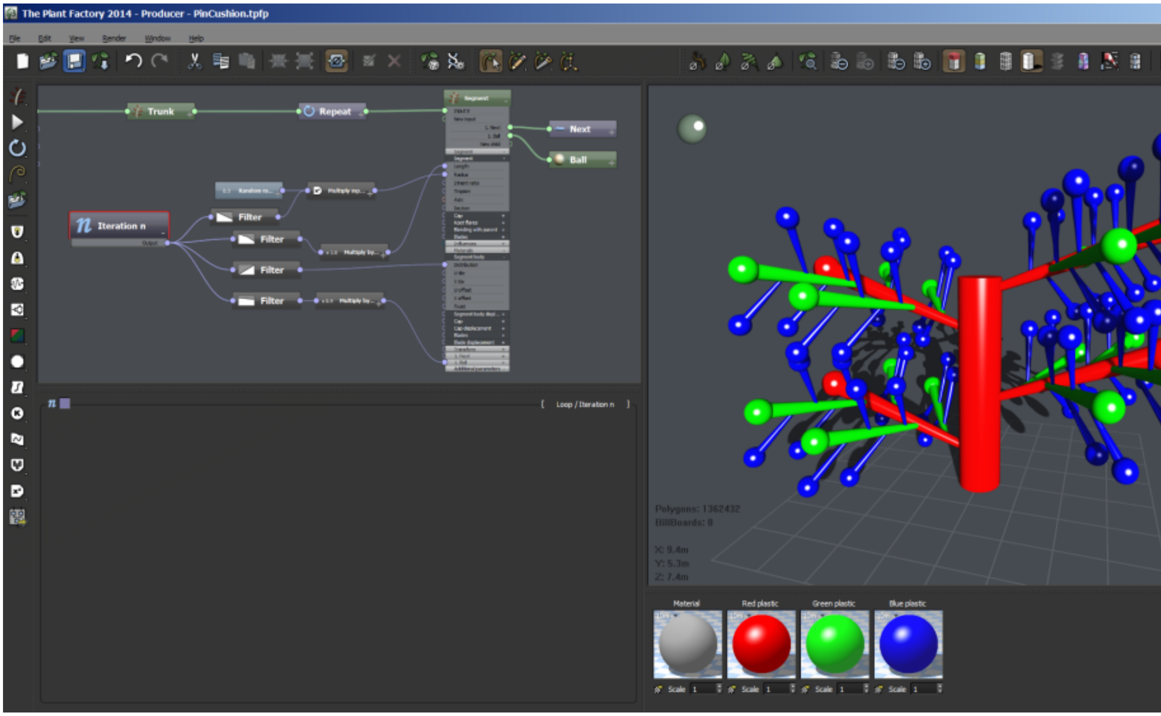
Loop Nodes

Loop nodes create cycles of vegetation nodes inside the graph. For the node loop to work properly it should start with **Repeat** and end with **End**. When the graph evaluation process reaches the cycle end, it will go back to the loop beginning as long as the iterations number is not hit. The subgraph located inside the loop will then be evaluated several times.



Here is the complete list of the loop nodes :

- **All but last:** Relative to a recursive node set initiated by a Repeat node. All the nodes connected to it will be evaluated on all last iteration of the loop except the last one. It naturally makes no sense to use this node outside a loop.
- **End:** Relative to a recursive node set initiated by a Repeat node. All the nodes connected to it will only be evaluated on the last iteration of the loop.
- **Iteration n:** Returns the ratio of the completed to the maximal loop iterations. Outputs the loop iteration value between -1 (first iteration) and +1 (last iteration)



- **Next:** End of recursive node loop initiated by a Repeat node. The output nodes of the Next node will only be evaluated after the Repeat node specified iterations number.
- **Repeat:** Initiates a node loop. Everytime the node evaluation comes to the loop Next node, it will go back to this node unless the specified maximal number of iterations was hit.
  - **Iteration:** Specifies how many loop iterations should be done.

Spline Nodes

Spline nodes are user-configurable 2D/3D functions of **Primal**, **Section Angle** and **Radial**. They can be used for axis/section definition.

- **Primal:** This coordinate is the position on the segment axis, ranging from 0 (segment bottom) to 1 (segment top).
- **Section angle:** This coordinate is the angular position of the point in the plane orthogonal to the segment axis. It ranges from 0 to 1.
- **Radial:** This coordinate is the distance from the segment axis. It is always positive. These coordinates may be used as inputs in the graph, using the Primal, Section

angle, and Radial nodes.

Here is the complete list of the spline nodes :

- **Axis spline – Function:** Yields a 3D vector depending on position on the segment axis. The spline is defined procedurally. The axis is built step by step. On each step the values of the rotation and translation parameters are used to compute the position and orientation of the next step. The filters are of great use to define non-uniform effects along the axis.

  This node can be connected to the Axis parameter of the Segment node.

  Rotation: Rotation vector around the local axes that is applied on each axis generation step.

  - **X, Y, Z:** Amount of rotation around the local X, Y or Z axis that is applied on each axis generation step.

  Scale: Parameters for scaling the various axis construction effects.

  - **Length_scale:** Controls how much the axis grows in its current direction at each step.
  - **Step_scale:** Controls the influence of the translation of rotation effects.
  - **Steps:** Subdivision number used to build the axis.

  Translation: Amount of translation along the local axes that is applied on each axis generation step.

  - **X, Y, Z:** Amount of translation along the local X, Y or Z axis that is applied on each axis generation step.

- **Axis spline – Manual:** Yields a 3D vector depending on position on the segment axis. This can be used to define segment axis. The spline is defined manually using a dedicated editor to position points and set tangents. For more information, check the Axis Spline Editor page.

- **Profile spline:** Yields a 2D vector depending on position on the segment or urchin axis. The spline is defined manually using a dedicated editor. For more information, check the Profile Section Spline Editor page.

- **Section spline:** Yields a number depending on section angle. The function is defined manually using a dedicated editor. For more information, check the Section Spline Sets Editor page.

- **Section splines set:** Yields a 3D vector depending on position on the segment axis and section angle. The corresponding surface is defined manually using a dedicated editor. For more information, check the Section Spline Sets Editor page.

Miscellaneous Nodes

These nodes are used with vegetation nodes to drive functions or add rules to specify which inputs or outputs should be used for evaluation.

Other nodes are:

- **Primal:** Yields the position on the segment axis, ranging from 0 (segment bottom) to 1 (segment top).
- **Parent:** Yields the position of the current primitive instance on the axis of an ancestor primitive instance.
  - **Parent_index:** Number of hierarchical levels between the current primitive instance and the desired ancestor. If this parameter is 1, the ancestor is the primitive parent and this node will yield the position of this primitive instance on its parent.
- **Section angle:** Yields the angular position of the point in the plane orthogonal to the segment axis. It ranges from 0 to 1.
- **Radial:** Yields the distance from the segment axis.
- **Primitive instance position:** Yields the position of the primitive instance as a 3D vector.
- **Distance to root:** Yields the distance along branches from the bottom of the trunk.
- **Random range:** Yields the return value of a Random range parameter, a combination of a fixed value, variance, randomness, parent and primal filters. For more information, refer to the **Random Range Parameter** page.

Connectable Random range: Does the same thing as the **Random range** node except that the bounds of the randomness can be connected to any compatible output from the graph.

Studio, Producer

- **Multicurve:** Designed to modify the profile of the input values using a multicurve control.
  - **Graph:** It is used to determine the output profile. Double-click on the multi-curve control to load a new multicurve, or select **Edit** from the popup menu (right-click) to edit the multi-curve. See the **Multicurve Editor** page for further information.
- **Random inputs:** Randomly selects an input from all connected inputs. The graph evaluation will then continue as if the output were connected to this input only.
  - **Presence_for_input:** Relative probability for the node connected to the given input to be selected.
- **Random children:** Randomly selects an output connection. Only the nodes connected to the chosen connection will be evaluated and built.
  - **Presence:** The presence (probabilities of generation) of all connected children can be defined here. There will be as many presence parameters as connected outputs.
  - **Presence_for_child:** Relative probability for the nodes connected to the

given output to be chosen for evaluation.

- **Spread children:** Alternatively selects an output connection. Only the nodes connected to the chosen connection will be evaluated and built.
- **Sequence children:** Alternatively select the output whose connected nodes will be evaluated and built according to a letter sequence. When connecting a node as output to the Sequence children node, note that the connection is renamed using letters like A, B, C... The sequence given in the node parameter should make use of these letters.
  - **Base Properties:** Main properties of the Sequence children node. The **Sequence** indicates the order in which the outputs to build should be chosen. The letters should match the connection names.
  - **Segment:** Main properties of the Sequence children node. The **Sequence** indicates the order in which the outputs to build should be chosen. The letters should match the connection names.
- **Select 2 children:** Has two vegetation outputs. The only one that will be built depends of the comparison of an input value against a threshold.
  - **Level:** Threshold to be compared against the node input value to determine which output will be evaluated and built.

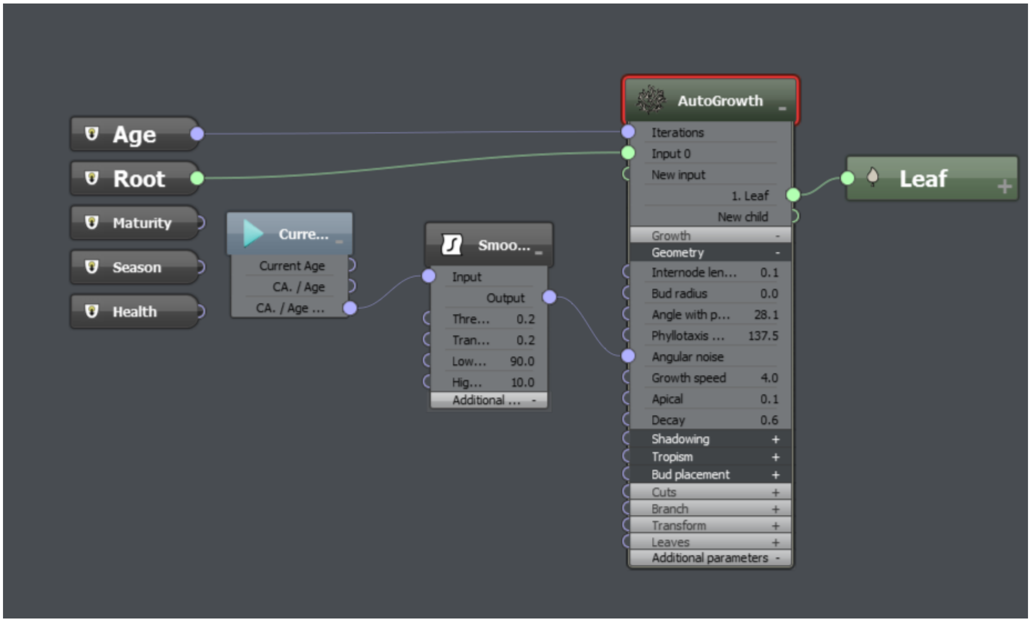
    The nodes connected to one output will be evaluated and built whilst the nodes connected to the other output will be ignored. The selected output for evaluation will be :
    * **Output 0:** if the input number value is lower than the level
    * **Output 1:** if the input number value is greater than the level
- **LOD Selector:** selects an output connection depending on the Level Of Details computed.
- **Geometry Target Selector:** selects an output connection depending on the geometry type computed.

Current Age

Specifically used with the AutoGrowth node, the **current age** is accessible to control the other parameters during the growth simulation.

The current age starts at 0 and grows up to the number of iterations of the growth node.

You can access it either using the **red filter**, or the Current Age node as in this graph:



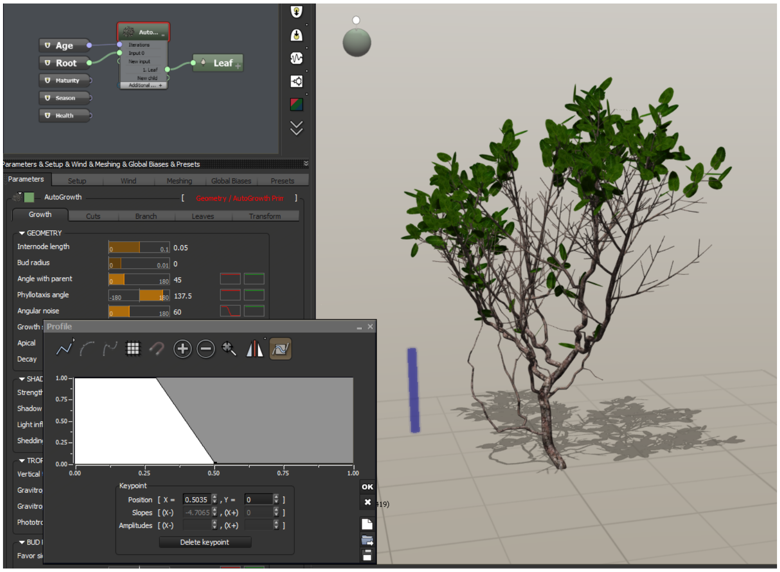
This node has multiple output variants:

Current Age over Age Max node

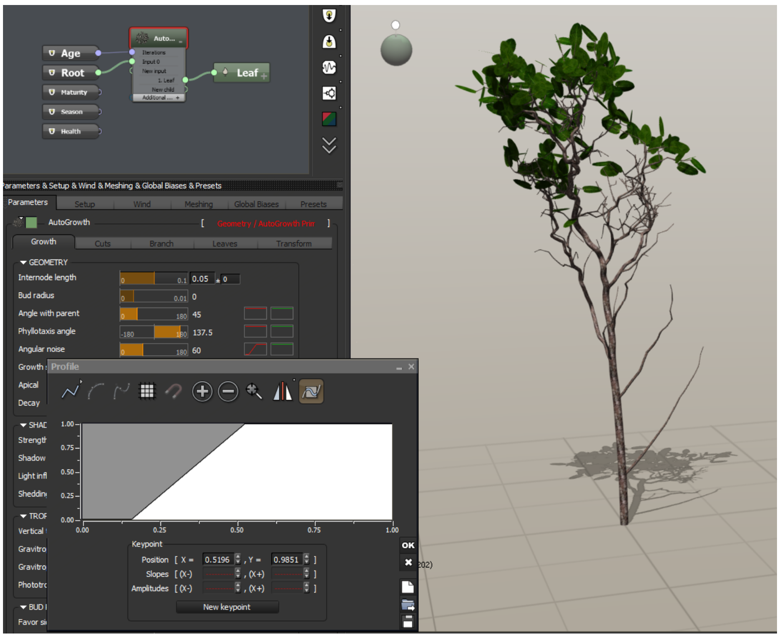
This represents the value of the current iteration number during growth divided by the **Maximum age** setting of the plant.

Use this to define parameter transitions which no not change when the plant age varies.

This is what is used by the **red filter**. Here is a sample demonstrating noise control over age:



Age
Root
Maturity
Season
Health
Auto...
Leaf
Parameters & Setup & Wind & Meshing & Global Biases & Presets
Parameters
Setup
Wind
Meshing
Global Biases
Presets
AutoGrowth
Geometry / AutoGrowth Pre
Growth
Cuts
Branch
Leaves
Transform
GEOMETRY
Internode length
Bud radius
Angle with parent
Phyllotaxis angle
Angular noise
Profile
Keypoint
Position [X = 0.5035 , Y = 0]
Slopes [(X-) -4.7065 , (X+) 0]
Amplitudes [(X-) , (X+)]
Delete keypoint
OK



Age
Root
Maturity
Season
Health
Auto...
Leaf
Parameters & Setup & Wind & Meshing & Global Biases & Presets
Parameters
Setup
Wind
Meshing
Global Biases
Presets
AutoGrowth
Geometry / AutoGrowth Pre
Growth
Cuts
Branch
Leaves
Transform
GEOMETRY
Internode length
Bud radius
Angle with parent
Phyllotaxis angle
Angular noise
Profile
Keypoint
Position [X = 0.5196 , Y = 0.9851]
Slopes [(X-) , (X+)]
Amplitudes [(X-) , (X+)]
New keypoint
OK

Current Age over Age

This represents the value of current iteration number during growth divided by the **Age** setting of the plant.

Use this to define parameter transitions which change with plant age variations. Note you won't have plant a shape continuity when changing it's age when this value is used.

Current Age node

This represents the current iteration number during growth, ranging from 0 to the age you set in the Age parameter of the growth node.

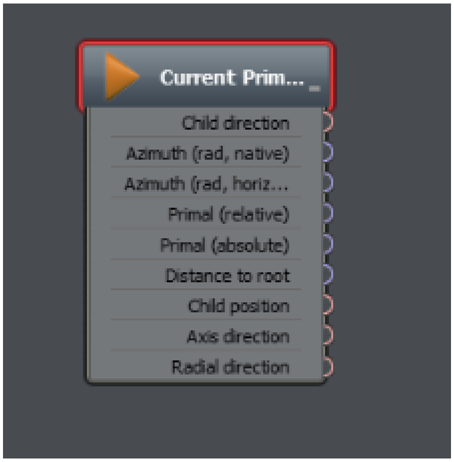
Use this to define parameter transitions based on age values : for instance connect a threshold node, and set the threshold value to some number of iterations.

Current Primitive

The **Current primitive** node allows to use intermediate data computed during plant generation. It represents the primitive currently being computed by the plant's graph. It allows to control some parameters using the various outputs of this node.

For now, it is only usable for the branch/segment/trunk node, to control the Pruning and the Segment body displacement.

More possibilities will be added in the future. At the moment, we do not allow to connect that anywhere as a lot of combinations do not make sense or are extremely be difficult to compute.



Primal (relative)

This is the same as the **Primal** node, it yields the position on the segment axis, ranging from 0 (segment bottom) to 1 (segment top).

Primal (absolute)

This yields the position on the segment axis as a distance, ranging from 0 (segment bottom) to the segment length before any cut (segment top).

Azimut (native)

This is similar to the **Section Angle** node, it yields the angular position of the point in the plane orthogonal to the segment axis.

But this one is expressed in **radians**, so that you can plug it directly to trigonometric functions.

It is in the [0, 2] range.

Azimuth (Horizontropic)

This is similar to the **Azimut (native)** node, but the **zero** represents the zenith around the current primitive, whereas the zero of the **Azimut (native)** node can be anywhere, depending on the bending of the segment.

It is in the [0, 2] range.

Axis Direction

This gives the current direction the segment axis (note this direction changes with the primal value).

A typical use is to take dot product of this value and a unit vector to control something (for instance the cut probability of the pruning or the segment body displacement).

Radial Direction

This gives the current radial direction (this direction changes with the primal and azimuth values).

Note this is not the normal to the surface of the segment, they differ when the segment is not a cylinder.

This is a unitary vector, the typical use is to plug it into a “Dot product” node with a direction of interest as second argument.

Child Direction

This gives the direction of the current child as a unit vector in the plant frame.

This can be used to control the pruning (for instance using the dot product of this with a constant unit vector).

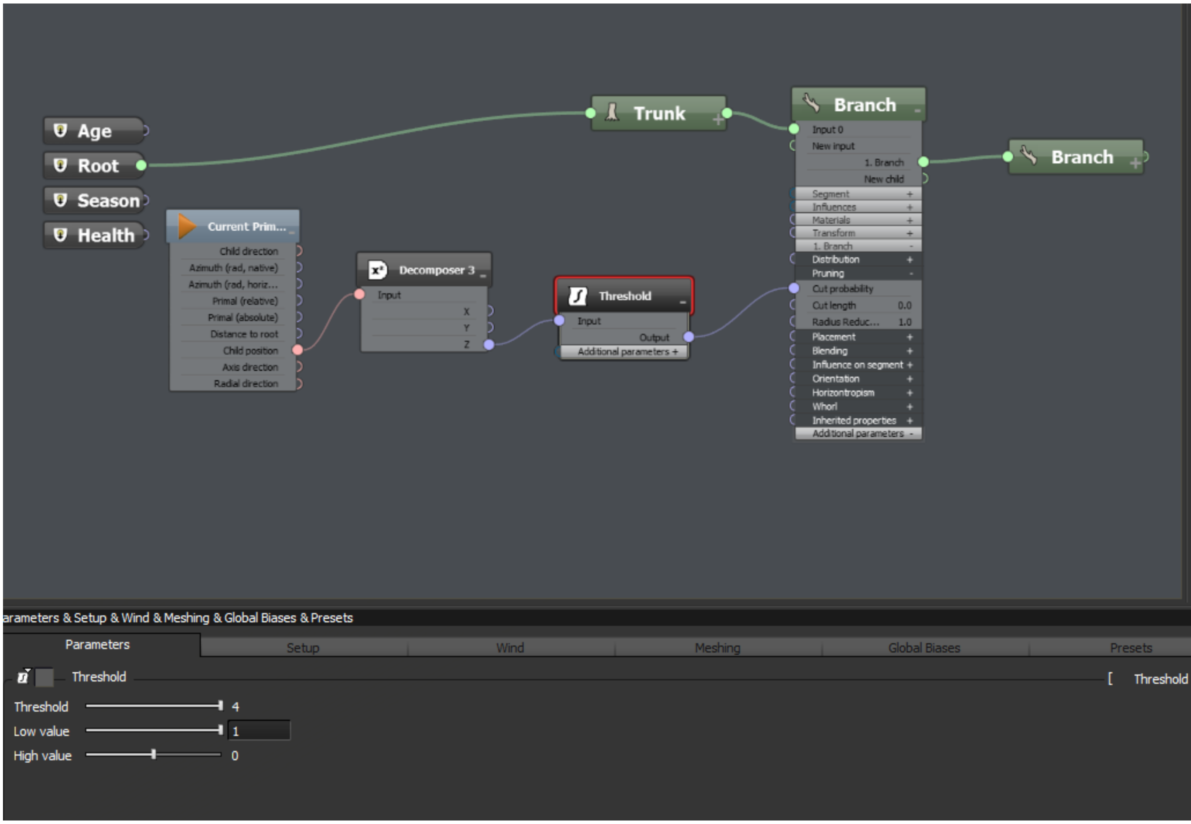
This is a unitary vector.

Child Position

This gives the position of the current child in the plant frame.

This can be used for instance to cut all branches below a height value to simulate the effect of animals eating those branches:

- Plug a Decomposer3 node to the "Child Position" output,
- Plug the Z output of the Decomposer3 node to a threshold node.
- Plug the output of the threshold node to the Cut probability input of the branch on which you want to cut children branch.
- Set the threshold to the height below which you want to cut things.
- Set the low value to 1 (will cut all)
- Set the high value to 0 (will cut none)



Distance to root

This gives the current distance to the plant's root, following the segments.

Parent Parameters

This node may be used to make a parameter of a child primitive instance dependent on a characteristic of its parent primitive instance.

Select the desired parent node in the first selection box. The second box will then display the list of its selectable parameters:

- **Position on primitive Instance:** values between 0 (bottom) and 1 (top)
- **Radius:** TPF units (m, cm etc.), same value as the one which is set for "Radius"
- **Length:** TPF units (m, cm etc.), same value as the one which is set for "Length"
- **Remaining length:** TPF units (m, cm etc.), remaining length from the child's

position to the end of the parent

- **Blade Width:** TPF units (m, cm etc.), same value as the one which is set for "Blade Width"
- **Angle:** Same value as the one which is set for the Angle
- **Roll:** Same value as the one which is set for the Roll
- **Rotation:** Same value as the one which is set for Rotation
- **Coil:** Same value as the one which is set for the Coil
- **Spread:** Same value as the one which is set for the Spread
- **Start Angle to vertical:** angle of instance with the vertical axis
- **Twist:** Same value as the one which is set for the Twist-Bias
- **Density:** Values between 0 and 1. Values are determined through both density filter curves in the Children-tab.
- **Scale:** TPF units (m, cm etc.), same value as the one which is set for "Scale"

Control Nodes

Studio, Producer

Input Nodes

Studio, Producer

Plant Graph

Studio, Producer...

- **Age:** Yields the current age of the plant in years. The current plant age can be set in the General parameters dialog and may be used to drive parameters in vegetation nodes and materials.
- **Maturity:** Yields the current age of the plant as a ratio of the maximum age of the plant. The current and maximum plant age can be set in the General parameters dialog and may be used to drive parameters in vegetation nodes and materials.
- **Health:** Yields the health value for the plant ranging in $[0; 1]$. 0 means the plant is dying, 1 means it is thriving. The current plant health can be set in the General Parameters dialog and may be used to drive parameters in vegetation nodes and materials.
- **Object Center:** Yields the plant origin position as a 3D vector. This may be used to drive parameters in vegetation nodes.

- **Position:** (only for displacement) Returns the position of the point being computed (before displacement).
- **Root:** Basis for all plants or objects. It does not correspond to any geometry but the evaluation of the graph starts there. If your graph is not linked to the root node, no geometry will ever be generated.
- **Season:** Yields a value in $[0;1]$ which has then to be interpreted as the current position in the course of the year. The current season can be set in the General parameters dialog and may be used to drive parameters in vegetation nodes and materials.
- **Time:** Yields the current time of the scene. This may be used to drive parameters in vegetation nodes, to configure plant animation.

…Studio, Producer

Material Graph

Studio, Producer…

When editing material functions, the list of additional input nodes that can be added to your function graph is as follows (depending on context, some of these input nodes may not be present, or may not generate intelligent values).

- **Position:** this input node produces a vector value representing the position of the point where the function is being evaluated. Obviously, the value of this input node depends on the mapping mode selected for the object's material.
- **Normal:** this input node produces a vector value representing the direction in which is pointing the surface at the point of evaluation of the function.
- **Position Options:** this is an advanced version of the position node above that lets you select the coordinate system in which the position vector is expressed. This input node displays a drop-down list that lets you select the coordinate system for this instance of the node (you can create several "Position Options" nodes with different coordinate systems). The different coordinate systems are the same as the coordinate systems available in the Material Editor's **Mapping** list. You can specify the **Distance unit** in TPF units, Display units or any other unit available in a drop-list for selection.
- **Normal:** this input node produces a vector value representing the direction in which is pointing the surface at the point of evaluation of the function.
- **Normal Options:** again, this is an advanced version of the "Normal" node described above. This input node lets you define the coordinate system in which the normal vector is to be expressed. The node displays a drop-down list that lets you select the coordinate system for this instance of the node (you can create sev-

eral “Normal Options” nodes with different coordinate systems). If you select the **Object** option, the normal vector is expressed in object coordinates, and hence is independent on the orientation of the object. On the other hand, if you select the **World** option, the normal vector will be modified by the orientation of the object.

…Studio, Producer…

- **Slope:** this input node produces a signal whose value is proportional to the local slope at the point where the function is being evaluated. If the surface is horizontal, the value of the input will be 1. If the surface is vertical, it will be 0. And if the surface is horizontal, only facing down, the value will be -1.
- **Altitude:** this input node produces a signal whose value is proportional to the altitude of the point where the function is being evaluated. The value of the input depends on the mapping mode, and can vary beyond the range -1 through 1.
- **Orientation:** this input node produces a signal whose value varies between -1 and 1 according to the azimuth of direction in which is pointing the surface at the point where the function is being evaluated. If the surface is pointing up along the Y axis, the input value will be 0. The signal jumps from -1 to 1 as the normal turns from south-west to south-east.
- **UV Coordinates:** this input node returns the texture coordinates of the current point, according to the selected texture mapping mode. It is created automatically when you create a Texture Map node. This node is typically used to drive the mapping of a texture. Please see the options of the UV Coordinates node for further details.
- **Time:** this input node returns the current time in seconds. This is used for animated functions. If you create a time-dependent node node in the Fractal category), a connection to this input node will automatically be created.
- **Angle of Incidence:** this input node returns the angle of incidence between the incoming ray (the ray coming from the camera, the reflected ray coming from a reflective surface, etc) and the surface of the object. If the surface of the object is exactly facing the ray (the incoming ray is perpendicular to the object surface), the input node returns a value of 1. At low incidence angles (when the ray is tangent to the surface), the return value is 0. If the ray hits the surface from the inside, the return value will be negative.
- **Ray Direction World:** this input node returns a vector that indicates the direction of the incoming ray expressed in world coordinates.
- **Ray Direction Object:** this is the same as the Ray Direction World input described above, except that the incoming ray direction vector is expressed in object coordinates instead of world coordinates. This is useful if you want to create a function that depends on the direction of the incoming ray, but is not affected by the orientation of the supporting object.

- **Position On Picture:** this input node returns a vector representing the position of the point in the final picture. The X and Y components of this vector respectively indicate the horizontal and vertical position of the point in the picture, where -1 is the left/top edge and +1 is the right/bottom edge of the picture. The Z component of the vector is always 0.

…Studio, Pro- ducer…

- **Distance to Camera:** this input node returns the distance between the point where the function is being evaluated and the camera, whatever the ray recursion depth. The distance to the camera is at most equal to the actual distance traveled along the ray. You can specify the **Distance unit** in TPF units, Display units or any other unit available in a drop-list for selection.
- **Distance on Ray:** this input node returns the total distance traveled by the ray from it's origin, including all recursions. This means that if the point where the function is being evaluated was hit by a reflected ray, the distance on ray would include the distance traveled by the reflected ray plus the distance traveled from the ray's origin to the point where it was reflected. You can specify the **Distance unit** in TPF units, Display units or any other unit available in a drop-list for selection.
- **Distance to Object Center:** this input node returns the distance between the point where the function is being evaluated and the actual center of the object that was hit by the ray. This would yield a constant value on a sphere, since, by definition, all points of the sphere's surface are at the same distance from the sphere's center. This is however not true for other geometries, and can also be useful when evaluating volumetric materials. You can specify the **Distance unit** in TPF units, Display units or any other unit available in a drop-list for selection.
- **Distance to Object Below:** this input node traces a ray downwards from the point where the function is being evaluated and returns the distance to the first object encountered. This could be useful for instance to evaluate the depth of an ocean and create foam (or waves) near the shore. Warning: because this input requires the actual tracing of a ray, it is very slow to process. You can specify the **Distance unit** in TPF units, Display units or any other unit available in a drop-list for selection.
- **Distance to Surface:** this input node returns the distance to the surface of the object. It is only defined for primitives and Metablob objects and is only really useful when computing volumetric effects (because it returns the distance to the surface, this input node will always return 0 when evaluating a standard material). You can specify the **Distance unit** in TPF units, Display units or any other unit available in a drop-list for selection.
- **Object Center:** this input node returns the coordinates of the center of the object that was hit by the ray. Obviously, this value is constant over the entire surface

of the object, but it can be particularly useful to switch textures in an EcoSystem population.

...Studio, Producer...

- **Object specific:** This function is used when building materials using plant geometry information:
  - **Primitive parameter:** Yields the position on the primitive axis, ranging from 0 (primitive bottom) to 1 (primitive top).
  - **Primitive section angle parameter:** Yields the angular position of the point in the plane orthogonal to the primitive axis. It ranges from 0 to 1.
  - **Primitive radius:** Yields the distance from the primitive axis.
  - **Primitive age:** Yields the age of the primitive.
  - **Primitive depth:** Yields the number of ancestors in the plant hierarchy of the primitive.
  - **Parent primitive parameter:** Yields the position of the current primitive instance on the axis of an ancestor primitive instance.
  - **Parent primitive section angle parameter:** Yields the angular position of the current primitive instance in the plane orthogonal to the axis of an ancestor primitive instance.
  - **Parent primitive radius:** Yields the distance of the current primitive instance from the axis of an ancestor primitive instance.
  - **Child distance:** Yields the distance from the nearest child of the primitive
  - **Maturity:** Yields the current age of the plant as a ratio of the maximum age of the plant.
  - **Season:** Yields a value in $[0;1]$ which has then to be interpreted as the current position in the course of the year.
  - **Health:** Yields the health value for the plant ranging in $[0;1]$. 0 means the plant is dying, 1 means it is thriving.
- **Incident Light Angle:** this input node returns the angle of incidence between incoming light rays and the surface of the object. If the light hits the object's surface perpendicularly, the value returned by the input node is 1. If the light hits the object's surface at a very low angle of incidence, the value will be close to 0. This is useful e.g. if you want to create a custom BRDF (Bidirectional Reflectance Distribution Function) for your materials. Obviously, the value returned by this input node is usually different for each light source. This input is only valid when evaluating the specular contribution.
- **Specular Light Angle:** this input node returns the dot product between the

direction of incident light and the direction of reflection of the viewing ray. This is useful for create custom specular reflection effects. Obviously, the value returned by this input node is usually different for each light source.

...Studio, Producer

- **Light Direction:** this input node returns the direction of the incoming light expressed in world coordinates. Obviously, the value returned by this input node is usually different for each light source.
- **Light Color:** this input node returns the color and intensity of the incoming light. Obviously, the value returned by this input node is usually different for each light source.
- **Reflected Direction:** this input node returns the direction of reflection of the viewing ray, expressed in world coordinates.
- **Anisotropic Direction:** this input node returns the direction of the "scratches" used to compute anisotropic reflections, expressed in world coordinates.
- **Transformed Z Vector:** this input node returns the direction of the upwards vector transformed by the object's transformation matrix, expressed in world coordinates. This basically tells you which direction is "up" on an object, taking into account the rotation of the object.

  Note:

  The resulting vector is not necessarily of length 1.
- **Transformed Left Vector:** this input node returns the direction of the left vector transformed by the object's transformation matrix, expressed in world coordinates. This basically tells you which direction is "up" on an object, taking into account the rotation of the object. Please note that the resulting vector is not necessarily of length 1. This, together with the "Transformed Z Vector" provides all information about the object's transformation matrix.

Output Nodes

Studio, Producer

Plant Graph

Studio, Producer

- **Vegetation output:** (Only for component) Create an output in component to link geometry node

Studio, Producer...

Color Nodes

…Studio, Producer

Color nodes all output a color. Depending on the type of node, they either convert a number into a color (the color creation nodes), or convert one color into another color (the color correction nodes). The Color Map node can also output an alpha value.

Color Creation Nodes

Studio, Producer…

Color Map

This node basically converts a number in between -1 and 1 into a color or an alpha value using a color map.

- **Color map:** this defines the color map used for the conversion of the input value into a color and alpha. You can load a color map by double-clicking on the color map control, and you can edit the color map by selecting **Edit Color Map** from the popup menu.

If you connect another node to an output of this color map node, you will have the choice of connecting to its color output, or its alpha output.

2 Color Output

This node produces only two colors, according to the value of the input.

- **Color 1:** if the input value is less than the threshold, the node outputs this color.
- **Color 2:** if the input value is greater than the threshold, the node outputs this color.
- **Threshold:** defines the value at which the output color switches from the first to the second color.

Linear Interpolation 2

This color node blends the two colors according to the input value.

- **Color 1:** this defines the color output by the node when the input value is -1.
- **Color 2:** this defines the color output by the node when the input value is +1.

Spline Interpolation 2

…Studio, Producer…

This color node blends the two colors according to the input value. This is similar to the previous node, except that the interpolation profile favors the extreme colors (you will see more of the actual 2 colors you defined than you would using the linear interpolation node).

- **Color 1:** this defines the color output by the node when the input value is -1.
- **Color 2:** this defines the color output by the node when the input value is +1.

3 Color Output

This is similar to the 2 color output node, only this node can output any one of three colors, according to the value of the input relative to the values of the 2 thresholds.

- **Color 1:** if the input value is less than the first threshold, the node outputs this color.
- **Color 2:** if the input value is greater than the first threshold, and less than the second threshold, the node outputs this color.
- **Color 3:** if the input value is greater than the second threshold, the node outputs this color.
- **First threshold:** defines the value at which the output color switches from the first to the second color.
- **Second threshold:** defines the value at which the output color switches from the second to the third color.

Linear Interpolation 3

This color node blends the three colors according to the input value.

- **Color 1:** this defines the color output by the node when the input value is -1.
- **Color 2:** this defines the color output by the node when the input value is 0.
- **Color 3:** this defines the color output by the node when the input value is +1.

Spline Interpolation 3

This color node blends the three colors according to the input value. This is similar to the previous node, except that the interpolation profile favors the extreme colors (you will see more of the actual first and third colors you defined than you would using the linear interpolation node).

- **Color 1:** this defines the color output by the node when the input value is -1.
- **Color 2:** this defines the color output by the node when the input value is 0.
- **Color 3:** this defines the color output by the node when the input value is +1.

...Studio, Producer

Color Correction Nodes

Studio, Producer...

The color correction nodes apply modifications to the color that is passed to them as input.

Color Variation

This creates variation in roughness and noise using one color only.

- **Color 1:** click on the color box to select the color from the color chart.
- **Roughness:** defines the rough areas in the color.
- **Contrast:** defines the contrast of the changes made to the color.
- **Noise Variation:** use the slider to increase or decrease noise variation.
- **Strength:** defines the strength of the noise.
- **Noise Scale:** defines the overall scale of the noise.

Color Brightness Variation

This takes the variation from the Color Variation node and adds brightness and saturation to the mix.

- **Color 1:** click on the color box to select the color from the color chart.
- **Roughness:** defines the rough areas in the color.
- **Contrast:** defines the contrast of the changes made to the color.
- **Noise Variation:** use the slider to increase or decrease noise variation.
- **Color Variation:** this is the amount of variation in the color.
- **Brightness Variation:** this adjusts the brightness of the color.
- **Saturation Variation:** this increases or decreases the strength of the color.
- **Noise Scale:** defines the overall scale of the noise.

Two Color Variation

…Studio, Producer…

This creates variation in roughness and noise using one color only.

- **Color 1:** click on the color box to select the color from the color chart.
- **Color 2:** select a second color to mix with the first color.
- **Roughness:** defines the rough areas in the color.
- **Contrast:** defines the contrast of the changes made to the color.
- **Noise Variation:** use the slider to increase or decrease noise variation.
- **Noise Scale:** defines the overall scale of the noise.

Natural Color Blend 2

This produces more natural or realistic color variations for terrains, ground, or any natural element in the scene, and provide an easy access to settings such as contrast, balance or roughness.

- **Color 1:** click the color box to choose color 1 from the color chart.
- **Use color 2:** check to use a second color.
- **Color 2:** click the color box to choose color 2 from the color chart.

There are controls for you to manipulate the color(s).

- **Noise Scale:** defines the overall scale of the noise. This should typically remain high (2000 by default) for a terrain or ground.
- **Roughness:** defines the rough areas in the color.
- **Contrast:** defines the contrast of the changes made to the color.
- **Balance:** defines the balance of the two colors.
- **Distortion:** defines any distortion, if any.
- **Noise Variation:** use the slider to increase or decrease noise variation.
- **Alpha grain:** this should be enabled only if the current material layer is not a leaf layer. In this case, it automatically adds ALPHA to produce the same kind of pattern as the color noise.

Color Variation Map

This node takes advantage of color gradient maps to produce a mixed material.

…Studio, Producer

Color Map

Color Map: click the color box to select a gradient map to use.

Other

- **Roughness:** defines rough areas in the color.
- **Contrast:** defines the contrast of the changes in the color.
- **Noise Variation:** use the slider to increase or decrease noise variation.
- **Noise Scale:** set the scale of the noise pattern

Terrain Color Patterns

This node is a fractal function designed to create color patterns, typically for use in the *Material Editor's* functions. It produces a mix of smooth and rough variations of colors similar to the distribution of rocks on a sedimentary soil. It is in fact based on the new algorithm developed for Terrain Fractal 2.

The **Terrain Color Patterns** node provides several groups of parameters.

The **Roughness aspect** parameters are very much inspired from the "Ground aspect" parameters of the "Terrain Fractal 2" node.

- **Bump surge:** controls the contrast between rougher and smoother areas.
- **Roughness abundance:** controls the overall quantity of roughness present in the patterns.
- **Smooth Threshold:** controls the smoothness of the transition strip.
- **Roughness dispersion:** controls how much the roughness tends to be scattered in the patterns rather than gathered in specific areas.
- **Roughness trend at higher frequency:** controls whether roughness increases or decreases at higher frequency.

The **Strata processing** parameters are similar to those available on the "Strata" filter located in the "Recursive" filters subcategory:

- **Processing strength:** controls the influence of the strata filtering over the color patterns.
- **Layer spacing:** controls the height of the main layer.
- **Offset:** allows fine-tuning of the vertical strata pattern positioning with respect to the underlying patterns.

Common Settings

Studio, Producer…

The following setting is common to quite a few color correction nodes:

Allow luminous colors: when this option is checked, TPF will generate colors that are brighter than white. Such colors actually generate light; they can produce very interesting lighting effects when used in conjunction with a radiosity rendering. If you don't check this option, colors will be clamped at white.

Gamma

This color correction node lets you adjust the gamma setting for the color.

Gamma: the gamma color correction parameter. Higher gamma values will produce darker, more saturated colors.

Gain

This color correction node lets you adjust the gain setting for the color. Higher gain values boost the contrast of medium brightness colors.

Gain: the gain color correction parameter.

Brightness

This color correction node lets you adjust the brightness setting for the color.

Brightness: the brightness color correction parameter.

Contrast

This color correction node lets you adjust the contrast setting for the color.

Contrast: the contrast color correction parameter.

HLS Shift

HLS stands for Hue-Luminosity-Saturation. It is another way of working with colors than the standard Red-Green-Blue paradigm.

This color correction node lets you adjust the overall brightness (luminosity), color tone (hue) and saturation of your colors.

- **Hue shift:** this parameter controls the amount of shifting applied to the color's hue.

- **Luminosity shift:** this parameter controls the amount of shifting applied to the color's luminosity – in effect, a brightness setting.
- **Saturation shift:** this parameter controls the amount of shifting applied to the color's saturation. Strong negative values will convert all colors to black and white (desaturation).

…Studio, Producer…

HLS Color Shift

This color correction node is similar to the previous one, in the sense that it also lets you adjust the overall brightness, color tone and saturation of your colors – however, adjustment is done via a color instead of independent parameters.

HLS shift color: this color is used to define the color correction that is applied to the colors. The default color is a pale shade of blue. If you edit this color, you will notice that it corresponds to a medium setting (128) for hue, luminosity and saturation. If you modify the hue for this HLS shift color, this modification of hue will be applied to all the colors passed to the node. In the same way, if you modify the luminosity or saturation, this modification will be applied to the colors passed to the node.

Filter

The filter color correction node multiplies all colors by the filter color – as if colors where seen through a colored gel.

Filter color: this parameter defines the color applied as a filter. Double-click to edit the color.

Perspective

The perspective color correction node replaces darker colors with the perspective color.

Perspective color: this parameter defines the color used to replace the darker colors. Double-click to edit the color.

Color Blender

The Color Blender node will blend the input color with a solid color.

- **Blending color:** this is the color that will be blended in with the input color.
- **Blending ratio:** this controls the amount of blending that takes place between the input color and the blending color. The higher the value, the more the blending color affects the input color.
- **Color mask:** if this option is selected, the color is applied in replacement of the

input color. When the blending ratio is set to 0%, the color is applied as a mask. When set at 100% the color completely replaces the bitmap. If this option is not selected, the blending color is applied in product (as a filter). *…Studio, Producer*

Combiner Nodes

Studio, Producer

The combiner nodes take several inputs and combine them together into a single output. Most combiner nodes accept any type of input, with the exception of the Color combiner that only operates on colors, and the Combiner that only operates on numbers.

Combiner nodes that accept any type of data must receive the same type of data on all their inputs. This is why setting the first input locks the data type for other inputs.

Blender

Studio, Producer

The Blender node accepts two inputs and combines them together according to the combination mode and the ratio.

- **Ratio:** this parameter controls the relative importance of each one of the inputs in the final node's output. Small values will favor the first input, whereas larger values will favor the second input.
- **Combination mode:** this drop-down list defines the method used to combine the two inputs together:
  - **Blend:** values are averaged,
  - **Add:** values are added together,
  - **Max:** the biggest value is retained,
  - **Min:** the smallest value is retained,
  - **Subtract:** the value of the second input is subtracted from the first input,
  - **Multiply:** values are multiplied together.

Combiner

Studio, Producer…

The combiner node can only operate on numbers. It can however combine an unlimited number of inputs. By default, the combiner node is created with 2 inputs, but as soon as you connect all inputs, a new input is added.

The combiner node combines inputs according to the overall combination mode as well as “per input” settings. The Node Details area displays settings that are relative each one of the inputs. If more inputs are added, new settings are added accordingly.

…Studio, Producer

Combination mode: this drop-down list box lets you select how the different inputs will be combined. The different combination modes are the same as for the Basic Repeater fractal node.

Amplitude: this parameter controls the relative amplitude of each one of the inputs. The input is multiplied by the value of this amplitude parameter and offset according to the offset parameter below before being combined with the other inputs.

Offset: this parameter controls the relative offset of each one of the inputs. It is used together with the amplitude setting before the input is combined with the other inputs.

Color Combiner

Studio, Producer…

The color combiner node only works with colors. It is capable of combining an unlimited number of colors according to a combination mode.

- **Combination mode:** this drop-down list box lets you select the way the input colors will be combined:
  - **Blend:** the colors are mixed in equal proportions.
  - **Add:** the colors from different inputs are added together. The resulting color is necessarily brighter than the each one of the input colors.
  - **Subtract:** successive input colors are subtracted from the first color, and clipped to black. The resulting color is necessarily darker than each one of the input colors.
  - **Multiply all:** all colors are multiplied together. The dark areas in each one of the inputs will be dark in the final color, and white areas will be the same as the other colors.
  - **Divide:** successive colors are divided. Results can be unexpected…
  - **Min:** the final color is the minimum of each color component, and thus necessarily darker than any one of the inputs.
  - **Soft min:** this is the same as minimum, except that the color values are blended when they are close.
  - **Max:** the final color is the maximum of each color component, and thus necessarily brighter than any one of the inputs.

- **Soft max:** this is the same as maximum, except that the values are blended when they are close.
- **Red filter:** the first input color is multiplied by the red component of all successive inputs.
- **Green filter:** the first input color is multiplied by the green component of all successive inputs.
- **Blue filter:** the first input color is multiplied by the blue component of all successive inputs.
- **Luminosity value:** the first input color is multiplied by the luminosity of the successive colors.
- **Hue blend:** the hues of the different colors are blended. The saturation and luminosity of the first input color are retained in the final output.
- **Luminosity blend:** the luminosity values of the different colors are blended. The saturation and hue of the first input color are retained in the final output.
- **Saturation blend:** the saturation value of the different colors are blended. The hue and luminosity of the first input color are retained in the final output.
- **Hue shift:** the hue value of the first input color is shifted by the hue values of the successive colors. The saturation and luminosity of the first color are retained in the final output. Zero shifting occurs when the successive colors are Cyan (Hue=128).
- **Luminosity shift:** the luminosity value of the first input color is shifted by the luminosity values of the successive colors. The saturation and hue of the first color are retained in the final output. Zero shifting occurs when the successive colors have a luminosity value of 128.
- **Saturation shift:** the saturation value of the first input color is shifted by the saturation values of the successive colors. The luminosity and hue of the first color are retained in the final output. Zero shifting occurs when the successive colors have a saturation value of 128.
- **Slope blend:** the input colors are mixed in a proportion that depends on the local slope. The successive colors replaces the first color on vertical surface.

...Studio, Producer

Add

Studio, Producer

This combiner node outputs the sum of all its inputs.

Subtract

Studio, Producer

This combiner node subtracts from the first input all subsequent inputs.

Multiply

Studio, Producer

This combiner node outputs the product of all its inputs.

Divide

Studio, Producer

This combiner node divides the first input by all subsequent inputs.

Input Selector Node

Studio, Producer

The Input Selector node returns the value of one of its inputs (except the first one) depending on the value of the first input, **Selector**.

The **Selector** input values needs to be in the range [0,1[and the inputs selection is evenly distibuted on this range.

Ex: 4 connected inputs:

Input selection depending on Selector value

Image Combiner Node

Studio, Producer

The Image combiner node allows you to add bitmap images together, usually Image Sample Nodes, for a combined effect. An example would be a sand texture with rocks added. It takes the main (background) texture color as the first input, and then an arbitrary number of images, or image nodes in combination.

Studio, Pro- ducer...

Constant Nodes

...Studio, Producer

Constant nodes do not take any inputs. They output the value that is defined by the node.

Constant Number

Studio, Producer

Value: use this setting to define the number that is output by the constant node.

Constant Color

Studio, Producer

Color: use this setting to define the color that is output by the constant node. Double-click on the color to edit it.

Constant Coordinates

Studio, Producer

Value: use this setting to define the texture map coordinates that are output by the constant node.

Constant Vector

Studio, Producer

Value: use this setting to define the vector that is output by the constant node.

Random Constant Number

Studio, Producer

Value: use this to create a random seed for things like procedural materials.

Value From List

Studio, Producer...

This node defines a list of elements as a combo box.

When the list is defined, the return value of the node is the **index** of the selected item (starting at 0).

This node can be very useful in the context of published parameters.

Enter your list: use this to define the different items of your list. Items must be defined as following: *item1*; *item2*; ... . *...Studio, Producer*

Save: the combo box underneath will be updated with the defined list of items.

Lock: the list of items will be not editable anymore. To publish the parameter, the combo box must be locked.

Connectable Constant

Studio, Producer

Connectable constants are identical to regular constants, except that their value can be extracted. What is the point of extracting the value of a constant, you may ask? Indeed, in standard graphs, there is no point in doing so. However, connectable constants are very useful in the context of published MetaNode parameters, where a "published" connectable constant can be connected to other nodes at the higher MetaNode interface level.

Connectable constants can also be used to add a "name label" to intermediate values inside a graph, so as to improve overall readability of the graph.

Filter Nodes

Studio, Producer

Environment Sensitive Filters

Studio, Producer...

Environment sensitive filters are able to adapt their response according to the local altitude, slope and orientation.

Altitude

The Altitude filter modulates its response according to altitude. For points at low altitudes, the filter output will 0.

Influence: this setting controls the percentage of the input signal that is modulated according to altitude.

Min effect altitude: this setting controls the altitude below which the response of the filter is uniformly 0.

Max effect altitude: this setting controls the altitude above which the filter's output is identical to the input. In between the two altitudes, the response of the filter is a

…Studio, Producer…

blend of the two outputs.

If the two altitudes are inverted (i.e. max effect is actually lower than min effect), the behavior of the filter will be inverted (i.e. the filter will output 0 at all altitudes greater than min effect).

Slope

The Slope filter modulates its response according to slope. For points at low altitudes, the filter output will 0.

Influence: this setting controls the percentage of the input signal that is modulated according to slope.

Min effect slope: this setting controls the slope below which the response of the filter is uniformly 0.

Max effect slope: this setting controls the slope above which the filter's output is identical to the input. In between the two slopes, the response of the filter is a blend of the two outputs.

If the two slopes are inverted (i.e. max effect is actually lower than min effect), the behavior of the filter will be inverted (i.e. the filter will output 0 at all slopes greater than min effect).

Altitude and Slope

This filter is a combination of the two above filters. It modulates its response according to the altitude and the slope.

The **Min** and **Max effect** settings are identical to the two previous filters. The Altitude and Slope filter also lets you adjust the relative influence of altitude and slope on the filter's response through the use of the **Importance** settings. The higher the importance of altitude, the stronger the influence the altitude will have on the filter's output. Ditto for slope.

Orientation

The Orientation filter modulates its response according to orientation of the surface on which the function is being computed. For points of the surface aiming in the opposite direction to the favored azimuth, the filter output will 0.

Favored azimuth: this parameter controls the azimuth of the direction in which the response of the filter will be unmodified. As the surface points away from this favored direction, the response of the filter gradually decreases until it reaches 0.

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Tightness: this parameter controls the angular tolerance around the favored azimuth. If the tightness is 0, all points that are less than 90° away from the favored azimuth will get some filter response. Points that look in the opposite direction will get 0 response.

Transition speed: this parameter controls the speed at which the filter transitions from no response to full response as the surface points more towards the favored azimuth.

Environment

The environment filter is a combination of the orientation filter and the altitude and slope filter.

The parameters in the Environment filter are identical to those of these two filters (see above for a description of these parameters).

Patches

The Patches filter is a very special filter that automatically creates uniform patches on horizontal surfaces. The filter can output two values:

- **Patch value**: this is the standard filter's output,
- **Presence on patch**: this output is 1 if the current point is in a patch, and 0 otherwise.

When you connect a link to the filter's output, a menu will appear to let you select the desired output.

Altitude and slope settings: all the settings in the Altitude and Slope groups are identical to those in the Altitude and Slope filter.

Patch size: this parameter controls the average size of the patches.

Patch height: this parameter controls the average difference in height between areas that are on the patches, and areas that are outside the patches.

Noisiness: this parameter controls how uniform the edges of the patches are. Higher values mean that the patch edges are defined according to the variations in the underlying signal.

Transition speed: this parameter controls the speed at which the filter transitions from outside onto the inside of a patch. It affects the steepness of the patch edges.

Surface noise: this parameter controls the amount of underlying noise that remains at the surface of the patches.

Recursive Nodes

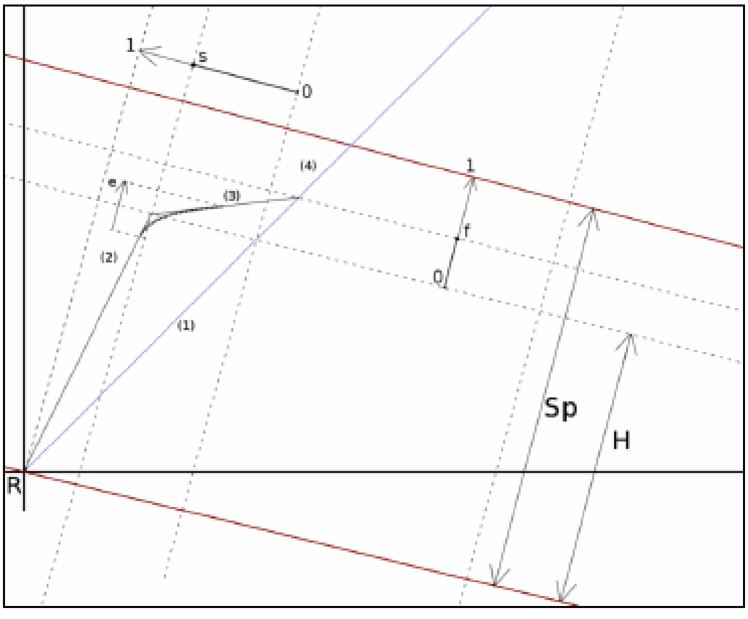
Studio, Producer...

The **Recursive** strata filters generate steps of a given size and orientation. The node is applied recursively until the setting limits are reached, exactly like a fractal.

The filter uses a pattern, repeated as many times as needed, spanning the whole (potentially tilted) Z axis in the standard

Strata filter or restricted to the confining range for the **Confined Strata** filter. At each iteration, the filter is applied on the result of the previous iteration, with all distance parameters halved (i.e. spacing and thickness).

Though the parameter names are semantically related to the concept of rock strata in a terrain, the filter can, of course, be applied to any kind of scalar input to generate a complex banded pattern. Once could also stratify a positions' coordinates before calling a fractal, to have a result along the x and/or y axis similar to what is obtained along the vertical axis when this filter is applied after a fractal's input.



Strata filter

Strata Processing Data Parameters

...Studio, Producer...

Processing strength: This indicates how much of the effect is actually taken into account in the output result. For example, if the value in this field is equal to .5, the output is half the input and half the stratified altitude.

Rock layer hardness (marked s on the diagram): The harder the layer, the steeper the filter's step between the bottom and the top of each rock layer.

Rock layer thickness (marked H on the diagram): The thickness can be smaller than the spacing between layers. Values higher then layer spacing are clipped. **Diagram – Strata node parameters Layer spacing**: This is the distance between the repetition of two filtering patterns (marked SP on the diagram).

Plateau filling (marked f on the diagram): This option controls the slope of the plateau. At 0, the plateau is parallel to the underlying planes, whereas as the value rises, the plateau is raised, taking over more and more in the invariant range, which is correspondingly reduced.

Smooth edges (marked e on the diagram): This is the range which the filtered input is smoothed to avoid too sharp edges on the output result. To avoid cluttering, the figure only shows smoothing on the transition -> plateau edge **(2)** to **(3)**, but the other two edges are smoothed as well **(3)** to **(4)**, i.e. plateau -> unchanged range, and **(4)** to **(2)**, unchanged range -> transition.

Smallest feature: This parameter tells how fine grained the filtering needs to be, i.e. how many iterations will occur.

These parameters are not measured directly on the input noise since the strata can be tilted. Rather, they are measured along the axis perpendicular to the potentially tilted strata planes.

Strata Positioning Features

Strata can be viewed as planes cutting through the terrain (or any other object). Parameters are:

Tilt heading (degrees): This defines the orientation of the axis around which the strata/planes will be tilted. In the diagram, this is represented in a vertical plane perpendicular to this axis.

Tilt angle (degrees): This defines the angle of rotation of the strata/planes.

Offset: This is an offset between the bottom of the "first" rock layer and the origin. Not shown on the diagram, this value would offset the point at which the strata crosses the origin R alone one the axis perpendicular to the strata, like the one marked **(5)**. It means the whole pattern of stratification (iterations included) is offset. Simulating strata deformation is then possible, by having the offset depend on **X** and **Y**.

…Studio, Producer…

Output: Detect Rough Areas

Like a fractal, this recursive filter is capable of outputting some measure of the variation induced on the input noise. The output will vary roughly in [-1:1]. Here is the meaning of the value output when only one octave is considered:

At -1, the input was not affected at all by the stratification process (range **(4)** on the diagram, or outside the confinement area, in the case of confined stratification).

At 0, the input landed on a plateau (range **(3)** on the diagram).

At 1, the input landed on a transition (range **(2)** on the diagram).

When several octaves of stratification are included in the second output computation, the values at each octave are summed, with coefficients for each octave depending on the value of the parameters.

Confined Strata

The **Confined Strata** filter requires another set of parameters for stratification altitude.

Don't stratify below: This is the bottom of the stratification range.

Don't stratify above: This is the top of the stratification range.

Fade in/fade out height: This is the distance along which the stratification area is faded in/out inside the stratification range. This smoothes the transition with the unfiltered range.

Origin is also added to **Strata positioning**, replacing the **Offset** parameter of the **Strata** function. With **Confined Strata**, a 3D offset is more practical. For example, when the strata is tilted, the confined range will only cross the input range in a specific area. To allow for precise control of this area's positioning, the origin must be fully customizable.

3D Stratification

This node uses as input a vector (like a position), and the result on the output position will be the same as applying a "Strata" filter node on each of the coordinates of the vector. It is easier to use because no composer/decomposer node is required, and the parameters for all three strata filters are gathered in a single, compact interface.

Since it filters a full 3D vector, a good place to insert it in a graph is between the input position and the fractal or noise node on which the effect is desired.

...Studio, Producer

Other Filters

Studio, Producer...

These filters are designed to modify the profile of the input values according to a simple filtering rule.

Filter

This filter uses a standard Filter control to determine the output profile.

Filter: this is the filter that is used to determine the output profile. Double-click on the filter control to load a new filter, or select **Edit** from the popup menu to edit the filter.

Partial Filter

This is similar to the previous filter, except that you can modulate the amount of the signal that is actually filtered through the filter.

Filter: see above.

Filter ratio: this parameter controls the level of filtering of the signal. If set to 0, the output is unfiltered. If set to 1, the output is identical to the above Filter node. If set to 0.5, half of the signal will be filtered, and the other half will remain unfiltered.

Offset ($X + a$)

This is a very simple filter that adds an offset to the input signal.

Offset: this parameter controls the amount that is added to the filter's input.

Opposite ($-X$)

This filter simply returns the opposite of the input signal.

Multiply (aX)

This filter simply multiplies the input signal by a value.

Multiply by: this parameter controls the amount by which the input signal is multiplied.

Divide (a/X)

This filter simply divides the input signal by a value.

Divide by: this parameter controls the amount by which the input signal is divided.

…Studio, Producer…

Brightness-Contrast ($aX + b$)

This filter combines the effects of the Offset and Multiply filters into a single, convenient filter.

Brightness: this parameter controls the amount that is added to the input signal (in effect, this acts as a brightness setting).

Contrast: this parameter controls the amount by which the input signal is multiplied (in effect, this acts as a contrast setting).

Parabolic ($aX^2 + bX + c$)

This is a slightly more complex filter that creates a parabolic output profile.

a, b and c: represent the different terms used in the parabolic equation $aX^2 + bX + c$.

Absolute

This filter simply mirrors the input value around the threshold value.

Contrast: this parameter controls the amount by which the input signal is multiplied (in effect, this acts as a contrast setting).

Threshold: this parameter controls the value at which the input is reversed. As a result, the output value can never drop beneath this threshold.

Gamma

This filter applies a gamma correction to the input signal.

Gamma: this parameter controls the gamma correction applied to the input signal.

Bias

This filter applies a bias correction to the input signal.

Bias: this parameter controls the bias correction applied to the input signal.

Gain

This filter applies a gain to the input signal.

Gain: this parameter controls the gain applied to the input signal.

…Studio, Producer…

Power

This filter calculates the difference between the input value and a lower clip value, and raises it to a given exponent.

Exponent: this parameter controls the exponent applied to the input value.

Lower clip: this parameter controls the value below which the filter's output is uniformly 0. Above this value, the filter's output is the difference between the input value and this value, raised to the power of the exponent.

Gaussian

This filter passes the input signal through a Gaussian curve, in effect producing a response similar to a smoother version of the Absolute filter described above.

Contrast: this parameter controls the amount of contrast in the resulting output.

Threshold: this parameter controls the lower limit around which the signal is "mirrored" by the Gaussian profile.

Floor

This filter clamps any value below the **Floor** value to that value.

Ceiling

This filter clamps any value over the **Ceiling** value to that value.

Clamp

This filter lets you clamp the input signal to a given range.

Lower clip: this parameter controls the lower limit of the range to which the signal is clamped. Any input below this value will result in an output equal to this value.

Upper clip: this parameter controls the upper limit of the range to which the signal is clamped. Any input above this value will result in an output equal to this value.

Clip

The Clip filter combines the effects of the Brightness-Contrast filter with the effect of the Clamp filter.

Contrast and Brightness: identical to the Brightness-Contrast filter settings.

Lower and Upper clip: identical to the Clamp filter.

Smooth Clip

…Studio, Producer…

The Smooth Clip filter is identical to the Clip filter described above, except that the output values are smoothed around the extremes, in order to avoid sharp variations in slope near the lower or upper clip values. In effect, this filter produces a slightly more contrasted result as the standard clip.

Map

The Map filter maps a given input range of values to a given output range. When connecting a parameter to another node, this filter is particularly useful to adapt the range of the signal to the range of values expected by the parameter.

Lower input value: this parameter controls the lower limit of the expected input range.

Upper input value: this parameter controls the upper limit of the expected input range.

Lower output value: this parameter controls the lower output value. This value is achieved when the input value is equal to the lower input value.

Upper output value: this parameter controls the upper output value. This value is achieved when the input value is equal to the upper input value.

Clip out of range values: if this option is selected, values that are out of the input range will be clipped to the input range (similar in effect to applying a clamp filter on this filter's input).

If the upper output value is less than the lower output value, the signal will be inverted.

Smooth Map

The Smooth Map filter is identical to the Map filter described above, except that the output values are smoothed around the extremes, in order to avoid sharp variations in slope near the lower or upper input values. In effect, this filter produces a slightly more contrasted result as the standard map. Values that are beyond the input range are automatically clipped to the input range.

Quantize

The Quantize filter convert the input into a range of discrete values.

Steps: this parameter controls the number of different values that the filter can output. For instance, if set to 5, the output will be quantized to 5 different possible values.

Contrast and Brightness: these settings are the same as those of the Brightness-

Contrast filter described above.

Saw Wave

The Saw Wave filter is equivalent to the fractional part of the input signal in the range of -1 through 1. When the signal reaches 1, it jumps back down to -1, creating a saw teeth like pattern.

Contrast and Brightness: these settings are the same as those of the Brightness-Contrast filter described above. Whenever the result of the brightness-contrast transformation exceeds 1, it jumps back down to -1.

Absolute Wave

The Absolute Wave filter is very similar to the Saw Wave filter, with the exception that the parts of the signal that are out f range are mirrored back instead of jumping back down. As a result, the Absolute Wave filter creates both up and down slopes, whereas the Saw Wave never inverts the slopes.

Contrast and Brightness: these settings are the same as those of the Brightness-Contrast filter described above. Whenever the result of the brightness-contrast transformation exceeds 1, it is mirrored back down.

Sine Wave

In effect, very similar to the Absolute Wave filter, except that this filter avoids the sharp changes in slope around the upper and lower limits. This version is usually preferred when the output is used to generate bumps.

Contrast and Brightness: these settings are the same as those of the Brightness-Contrast filter described above. Whenever the result of the brightness-contrast transformation exceeds 1, it is mirrored back down.

Threshold

This filter switches between two values depending on the input: if the input is less than **Threshold**, the node outputs the **Low value**. If it is greater, the node outputs the **High value**.

Smooth Threshold

This is similar to the **Threshold** filter, with the addition of a smooth transition strip, defined by the **Transition** parameter. Inside the transition strip, the node outputs a blend of both the **Low** and **High values**.

Fractal Nodes

Studio, Producer

Common Parameters

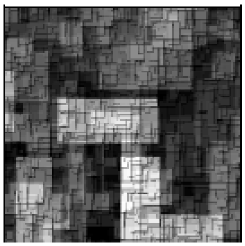
Studio, Producer...

The following settings are common to all fractal nodes (some of them are not available in the “Basic Repeater” or “Fast Perlin Fractal” nodes, because these nodes are simplified or degenerate forms of fractals).

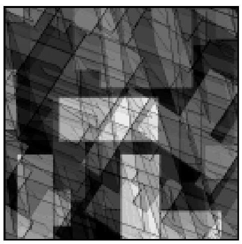
Base noise: to create its output, the fractal node replicates the base noise at different frequencies, and with different amplitudes. This drop-down menu box lets you select the noise to be used by the fractal. If the noise defines extra parameters, you can access these extra parameters by clicking on the

Edit button. This will open a Node Options dialog, letting you adjust the properties of the noise. If the noise has no extra parameters, the Edit button remain disabled. If you select a noise that is time dependent, a link will automatically be established with the “Time” input.

With rotation: check this option if you want the noise to be rotated in between each harmonic. This is useful if the base noise exhibits strong directional features and you want to minimize these directional features.



Without rotation



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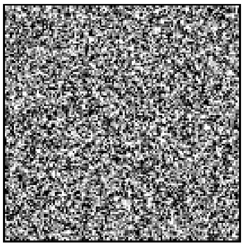

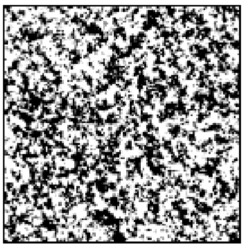

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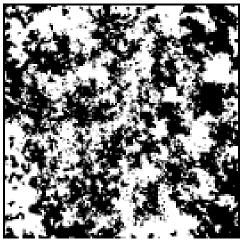
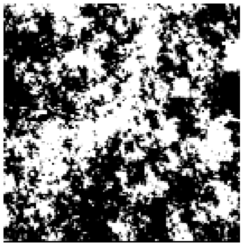
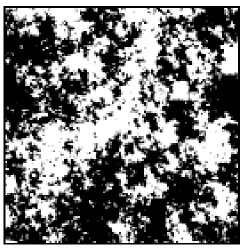


Largest feature = 2



Largest feature = 10

Smallest feature: by default, when computing a fractal pattern, TPF will keep adding detail until these details are so small that they cannot be seen in the final picture. This is the default behavior when the smallest feature setting is left at 0. There are cases where you may want to skip the smaller details in the fractal, in which case you should indicate the scale of the smallest details you want, using this setting.



Smallest feature = 0

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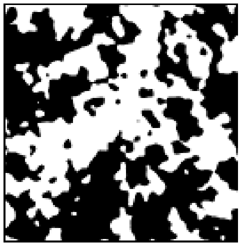
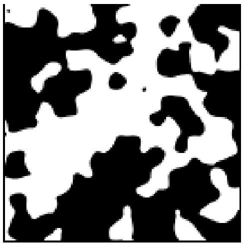
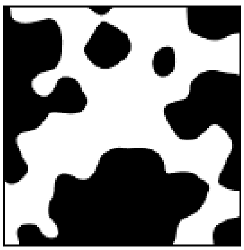


Smallest feature = 0.2

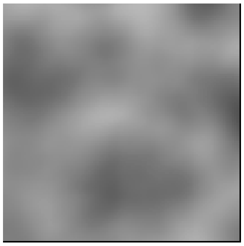


Smallest feature = 0.5



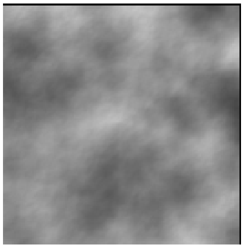
Smallest feature = .10

Roughness: this parameter controls the overall roughness of the fractal pattern. Namely, the amplitude of each iteration of the fractal's base noise is multiplied by the Roughness parameter. The default value of 0.5 will produce a fractal pattern with the same level of detail at all scales. Smaller values for the roughness parameter will produce a smoother surface, whereas values greater than 0.5 will yield spiky patterns with lots of small details.

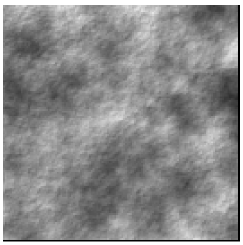


...Studio, Pro- ducer...

Roughness = 0.2



Roughness = 0.4



Roughness = 0.6

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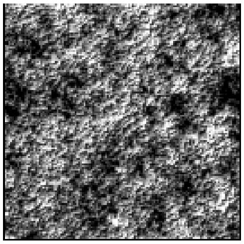
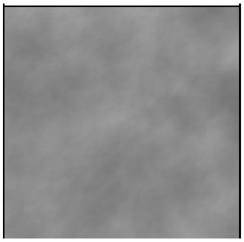
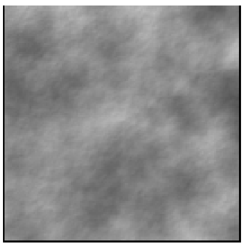


Roughness = 1

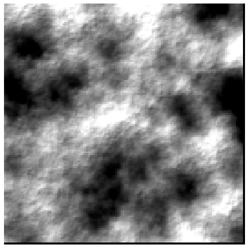
Gain: this parameter controls the overall amplitude of the signal output by the fractal. Because fractal patterns can have very large features, their output can be in a much larger range than the standard noise range of -1 through 1. You can use this parameter to tone down the amplitude of the fractal's output.



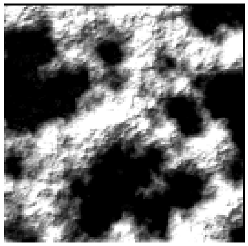
Gain = 0.5



Gain = 1



Gain = 4



Gain = 10

…Studio, Pro- ducer…

Stretch Damping: This setting is only available if the fractal is stretched along one or several axes (non uniform wavelength). Stretch damping will reduce the amount of stretching applied to the higher frequencies in the fractal, thus avoiding the entire fractal pattern looking as if it had been stretched.

The fractal's output is modulated by a user defined filter. The amount of filtering can be made to vary according to the harmonic. If no filter is defined, this processing is ignored. You can define the range of values in between which the filter is applied.

Filter: this is the filter that will define the profile of the altitudes. Double-click on the filter preview to load a new filter, or select **Edit** from the popup menu to customize the filter.

Function view

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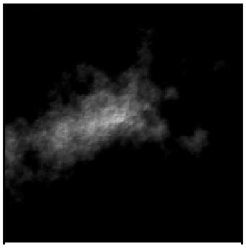
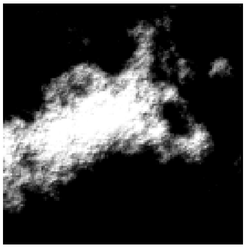
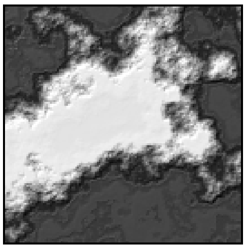
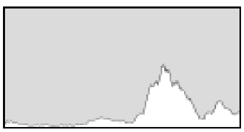


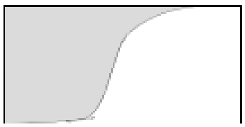


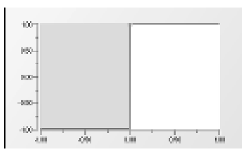


Function graph



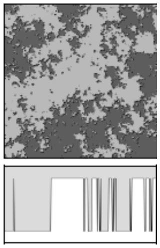
…Studio, Producer…



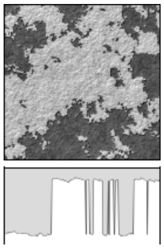


only). The Min and Max values are given as percentages of the full range computed by the fractal.

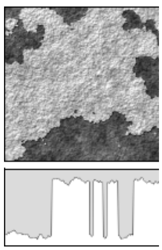
...Studio, Producer...



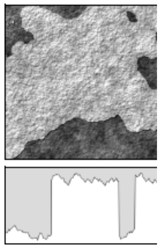
Creep in = 0



Creep in = 0.1



Creep in = 0.3



...Studio, Producer

Creep in = 0.5

Outputs: most fractals are capable of outputting both an **Altitude** value (the default usage) and also a **Rough areas** value, which can be used to drive the distribution of materials according to the local roughness of the fractal pattern. When the second output is connected, a 2nd output**: Detect rough areas** option appears with the **Ref. feature size** setting. This is typically used to control the distribution of materials on the terrain according to fractal roughness.

Basic Repeater

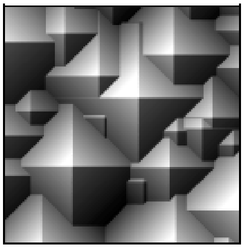
Studio, Producer...

The Basic Repeater is a special type of fractal that is in some respect "degenerate". The reason for this is that basic repeaters only add a limited amount of detail to their patterns, whereas true fractals will add infinite details. What this means is that if you zoom in close onto a basic repeater pattern, you will begin to notice the lack of detail. There are cases when the basic repeater can be useful because it offers greater control over the harmonic behavior of the noise. Whenever possible, however, you should prefer true fractal patterns.

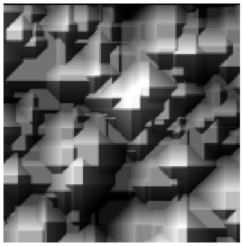
Although the Basic Repeater can have a filter assigned to its output values, the Creep in parameter defined above is not available in this node.

Repeat: this parameter controls the number of times the base noise is repeated in order to produce the final pattern. Higher values will produce very detailed patterns, but will take longer to render. It is rarely useful to use values higher than 4-6.

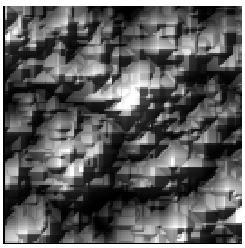
…Studio, Producer…



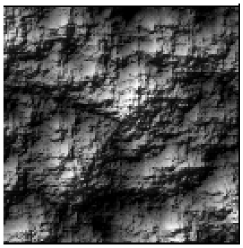
Repeat 0



Repeat 1

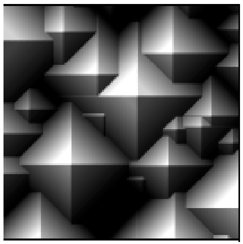


Repeat 2

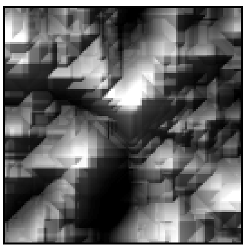


Repeat = 10

Scale: this parameter controls the scaling ratio that is applied to the base noise's wavelength in between each iteration of the noise. Values close to 0.5 produce the best results; values greater than 0.5 will enhance larger elements, whereas values under 0.5 will enhance the smaller details.



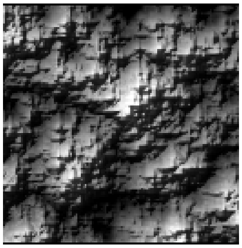
Scale 0



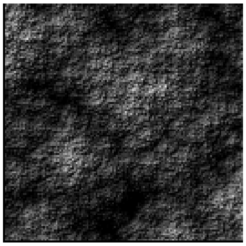
Scale 0.75

...Studio, Producer...

...Studio, Pro- ducer...

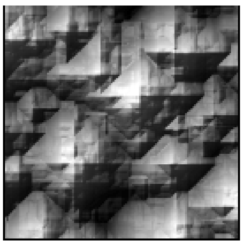


Scale 0.5



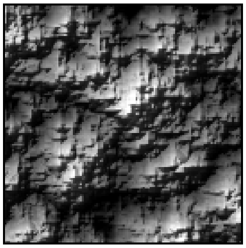
Scate 0.2

Amplitude: this parameter controls the amplitude ratio that is applied to the base noise's amplitude in between each iteration of the noise.

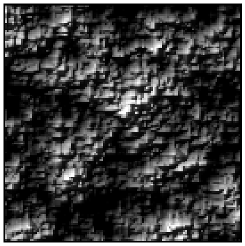


Amplitude 0.25

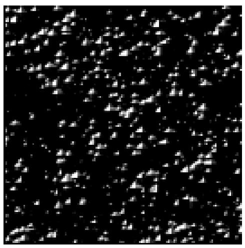
...Studio, Pro- ducer...



Amplitude 0.5



Amplitude 0.75



Amplitude 2

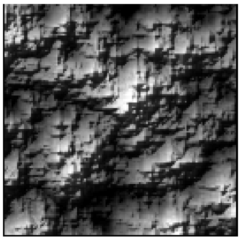
Combination mode: this drop-down list defines the method used to combine the noise iterations together:

- **Add:** values are added together.
- **Blend:** values are averaged.
- **Variable roughness:** values are added depending on the result of the first itera-

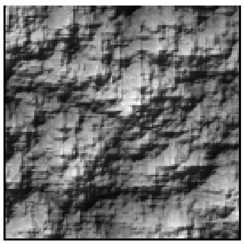
tion. Low first iteration values mean lots of successive iterations being added in, high values mean little influence of successive iterations.

...Studio, Producer...

- **Variable roughness (abs):** same as Variable roughness, except the distance to 0.5 is considered instead of the value of the first iteration itself.
- **Max:** the biggest value is retained.
- **Max (abs):** the value that is the furthest from 0.5 is retained.
- **Min:** the smallest value is retained.
- **Min (abs):** the value that is the closest to 0.5 is retained.
- **Multiply:** values are multiplied together.

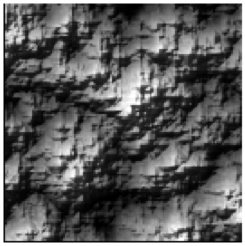


Add

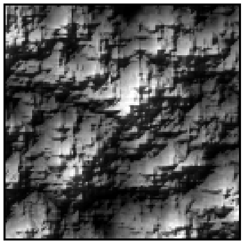


Blend

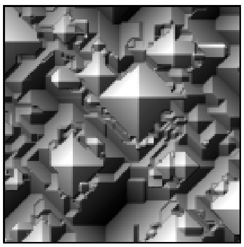
…*Studio, Producer*…



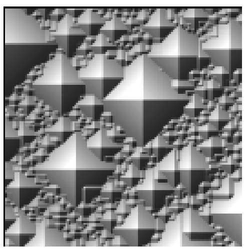
Variable roughness



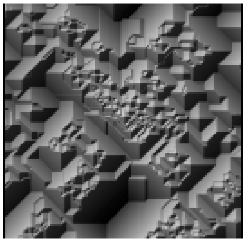
Variable roughness ABS

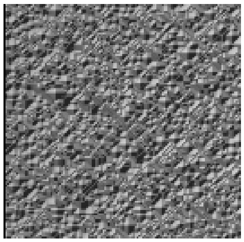


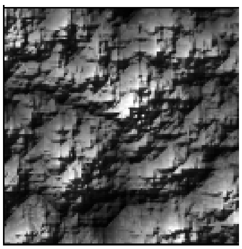
Max



…Studio, Producer







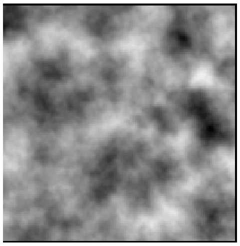
Simple Fractal

Studio, Producer…

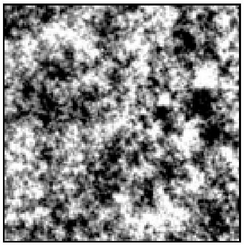
This is the simplest type of fractal. It repeats the base noise uniformly.

The simple fractal node does not define any additional parameters.

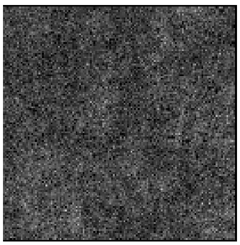
...Studio, Producer



Roughness 0.5



Roughness 1.0



Roughness 1.5

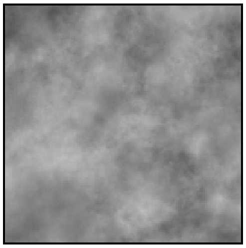
A cyclic version of this **Simple Fractal** is available. A cyclic **Animated Simple Fractal** is also available.

Studio, Producer...

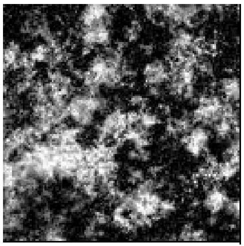
Grainy Fractal

...Studio, Producer

The Grainy fractal is particularly useful for color and bump patterns that exhibit a lot of detail at all frequencies.



Roughness 0.75



Roughness 1.0

With rotation: check this option if you want the noise to be rotated in between each harmonic. This is useful if the base noise exhibits strong directional features and you want to minimize these directional features.

Double noise: this option adds more interesting variations to the base noise. It is however more complex to compute.

Noise Variation: use the **Variation strength**, **Variation roughness**, and **Smooth area altitude** settings to control how the grain in the noise varies, and to create smooth and grainy areas.

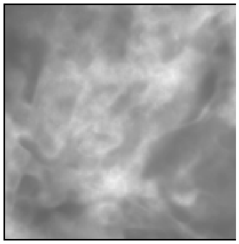
Other: use the **Distortion** and **Filter Steepness** to add distortion to the overall fractal pattern, as if it had been smeared around randomly. **Steepness** controls the amount of contrast in the noise.

A cyclic version of this **Grainy Fractal** is available.

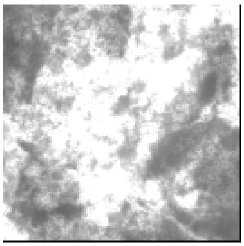
Terrain Fractal

Studio, Producer…

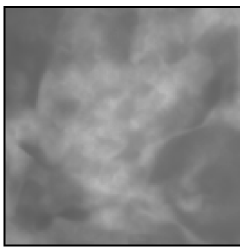
This is the same as the grainy fractal, except that the noise/landscape type parameter can be made to vary according to the altitude of previous iterations of the base noise. This results in smooth areas at certain levels, and rougher areas away from this level. This node is mostly used for creating natural-looking terrains.



Ridges Roughness 0.5

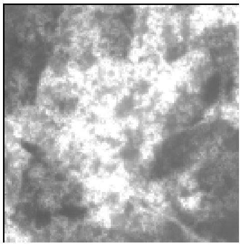


Ridges Roughness 1.0

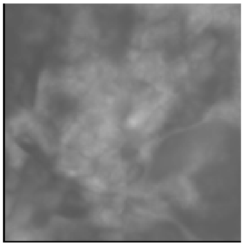


Plain noise Roughness .05

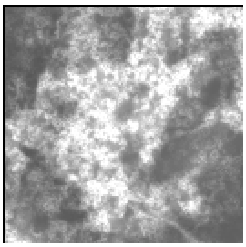
…Studio, Producer…



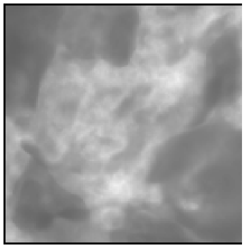
Plain noise Roughness 1.0



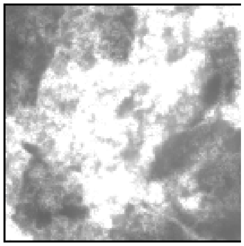
Billows Roughness 0.5



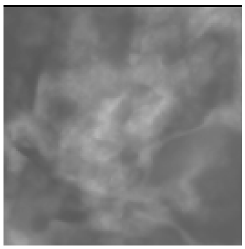
Billows Roughness 1.0



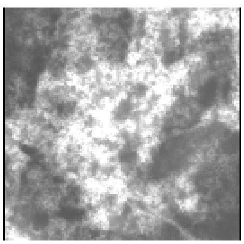
Ridge mix Roughness .05



Ridge mix Roughness 1.0



Billows-Ridge mix Roughness 0.5



...Studio, Pro-ducer...

…Studio, Producer

Terrain Fractal 2

Studio, Producer…

This node is a fractal function designed to create realistic terrain landscapes, similar to the **Terrain Fractal**. Differences are:

- This fractal has a better variability of shapes, and the rough areas simulating rocks and cliffs are more convincingly integrated in the relief.
- An optional stratification can be applied to create an effect similar to what a separate Strata Filter node would achieve if fed with the fractal's output, but with the added advantage of benefiting from knowledge of some of the fractal's internal value: For example, the strata follow the general relief of the landscape, to simulate the deformation of actual geological strata due to landscape movements after the formation of the strata themselves.
- Also, the stratification process is modulated to be much more visible on rough areas than on smooth areas. This is because the smooth areas represent parts of

the landscape where sediments have covered the underlying, stratified rocks.

- Like most other fractals, **Terrain Fractal 2** also provides a **2nd output** which value reflects the terrain roughness at the evaluated point.

...Studio, Producer...

Terrain Fractal 2 comes with several groups of parameters. The first group contains generic parameters which are the same as those seen on other fractals. Please refer to previous documentation for details.

The **Overall aspect** parameters control the influence of the first few octaves of the fractal over the rest of the algorithms. These octaves will define regions with different density of rocks.

Turbulence: controls the overall distortion of the terrain.

Turbulence damping: controls the influence of the first octaves' turbulence on subsequent octaves of noise.

Large scale smoothness: controls the smoothness of the transition from regions of low rock density to others of high rock density.

Large scale contrast: defines the range in which the rock population density can vary.

Buoyancy: controls the balance between large scale noise octaves and smaller scale ones. A positive buoyancy means that the average altitude will be low and the rocky features will raise above it, whereas with a negative value the features will dig below a higher average altitude. A null buoyancy means that the average altitude will be around zero while some features will be above it and some below it.

This fractal tries to simulate rocks emerging from a sedimentary soil. These rocks tend to be gathered at specific places where the soil thickness is lower, whereas in thicker soil areas they are almost all hidden below the sediments. The

Ground aspect parameters control this.

Bump surge: controls how much the rocks will spring up out of the ground.

Rock abundance: controls the quantity of rocks visible.

Soil thickness: controls the typical thickness of the layer covering the rocks. A thin layer will let more rocks show up, and most of the smoother areas will still retain a little bit of roughness. On the other hand, a thicker layer will cover more rocks, and most of the smoother areas will have almost no roughness at all.

Rock dispersion: controls how much rocks tend to be scattered in the landscape rather than gathered in specific areas.

...Studio, Producer

The **Strata processing** parameters are similar to those available on the **Strata** filter located in the **Recursive** filters subcategory:

Processing strength: controls the influence of the strata filtering over the landscape.

Layer spacing: controls the height of the main layer.

Offset: allows fine-tuning of the vertical strata pattern positioning with respect to the underlying terrain.

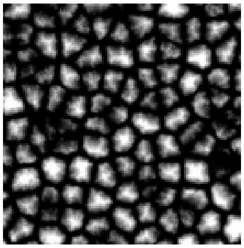
Rocky Mountains Fractal + Eroded

Studio, Producer...

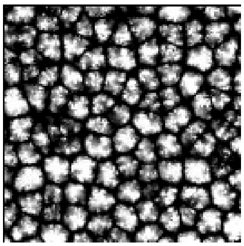
This is a new type of fractal that produces terrain features typical of the tertiary geologic period.

Terrain features generated by this fractal are fully user adjustable. The fractal can also be used to drive material distributions and produce a wide variety of appearances.

The **Base settings** section of the fractal settings are the same as the Terrain fractal.

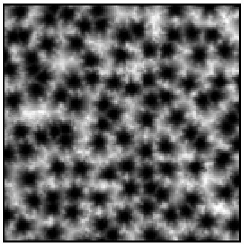


Separate mountains Roughness 0.5

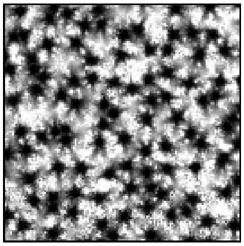


...Studio, Producer...

Separate mountains Roughness 1.0



No separate mountains Roughness .05



No separate mountains Roughness 1.0

Two flavors of this fractal are available in the **Overall aspects** section. The **Separate mountains** checkbox drives this difference. When this option is checked, the terrain appears as independent mountain "blocks" placed side by side. This is useful when in need of one or several big summits or to overlay on top of another relief. When the

Separate mountains option is unchecked, the terrain appears as independent basins separated by irregular mountain ridges. This can be a useful basis to define interconnected or separate valleys, especially with proper distortion.

Number of iterations: this fractal is very specific in that it produces irregular ridges that appear at each iteration. This means the lower frequency components will not be as visible as they are in regular fractals. The trade-off is that it can be quite slow to compute with a lot of iterations.

Subdivision quality: the algorithm is in fact an approximation of an algorithm intrinsically much slower. Therefore, some faults (discontinuities) can appear in the fractal. This quality parameter allows some control over the performance/quality trade-off of the implementation.

Scale factor: each new iteration adds irregularities at a scale smaller than the previous iteration. This parameter defines how much smaller each new iteration will be. A higher scale factor will allow for smaller details with fewer iterations, but it will also be more predictable and less appealing.

...Studio, Producer...

Flat level (per iteration): each iteration applies some pattern which is made of some very smooth areas and some much rougher, ridged areas. This parameter controls the balance between the two types of areas. A high value will leave fewer ridges, while a lower value will yield much smaller smooth areas.

Ground level: this parameter, especially useful when **Separate mountains** is ticked, makes the fractal "sink" into the ground.

Stretch and distortion

Stretch factor: the pattern applied at each new iteration is stretched along some privileged direction, to reflect the way real ridge networks actually look like in a mountain range. This parameter controls the amount of stretching. This parameter is ignored when the **Separate mountains** setting is not checked, unless you are using **Eroded Rocky Mountains**.

Distortion: this parameter is quite similar to its namesake in Terrain Fractal. It distorts the input coordinates in order to perturb the fractal overall aspect.

Optional rocks: when activated, this feature overlays rocks on top of the fractal itself.

Rock correlation: This optional feature adds rocks in the rough areas, while preserving the smooth aspect of the flatter areas. To do this, it relies on the ridges seen at the iteration given by this parameter.

Rock roughness and **Rock height**: These allow for finer control over the aspect of the overlaid rocky fractal, and behave like **Roughness** and **Gain** would in a regular fractal.

2nd Output: Detect rough areas

Ref. feature size: The rough area output is divided into two subranges for easier filtering:

- Where there are no overlaid rocks, the underlying fractal's rough value is used, as if **Optionalrocks** were set to **None**. It is mapped to [-1;0].
- On overlaid rocks areas, their height over the underlying fractal is used as "rough" value, mapped in $[0; 1]$.

This is how to detour the rocks, at least when second output's **Ref. feature size** is

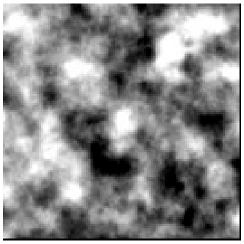
0. When it is not, rough area detection does not correlate with the terrain's aspect and rock detouring is no longer exact.

...Studio, Producer

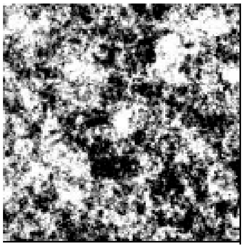
Fast Perlin Fractal

Studio, Producer

This is a highly optimized version of the Simple Fractal node, based on a standard Value-Perlin noise with rotation. The number of settings in this fractal is limited in order to maximize efficiency of the node. It is very useful for all cases where you need a basic – but good quality – fractal pattern.



Roughness 0.5



Roughness 1.0

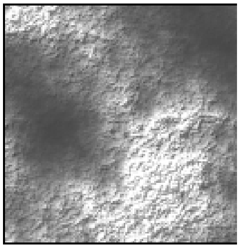
Variable Roughness Fractal

Studio, Producer...

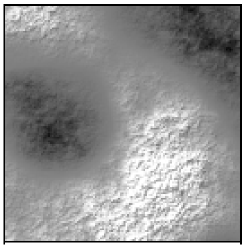
This is the same as the simple fractal, except that the roughness parameter can be made to vary according to the altitude of previous iterations of the base noise. This results in smooth areas at certain levels, and rougher areas away from this level.

Smooth level: this is the reference level for minimum roughness of the fractal. The roughness increases according to the distance to the smooth level.

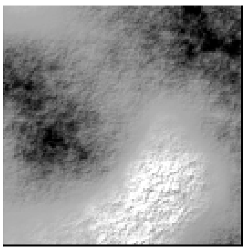
...Studio, Producer...



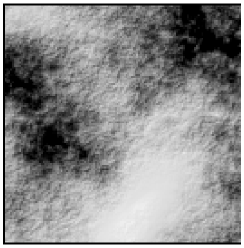
Smooth level -0.6



Smooth level -0.2



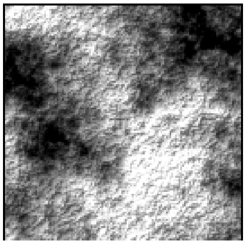
Smooth level 0.1



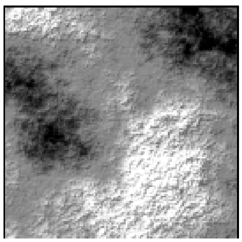
...Studio, Producer...

Smooth level 0.5

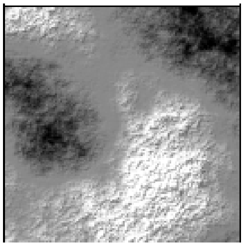
Influence: this parameter controls the influence of the altitude on the roughness. If set to 0, the Variable Roughness Fractal behaves exactly as a Simple Fractal.



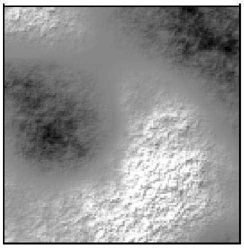
Influence 0



Influence 0.4

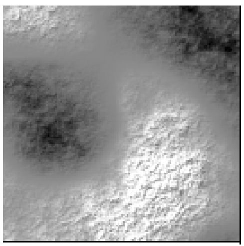


Influence 0.6



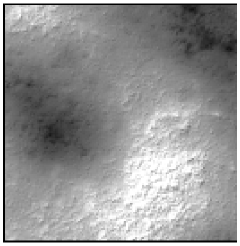
Influence 1.0

Local influence: this parameter controls how the roughness is computed according to altitude. If set to 0, the roughness is modulated by altitude only. If set to 1, the roughness will be modulated by the altitude of the last iteration of the noise, resulting in local patches of “smoothness” appearing at different altitudes.

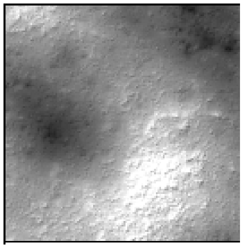


Local influence 0

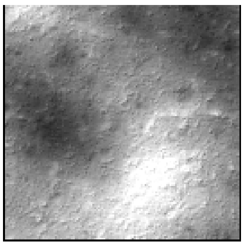
…Studio, Pro-ducer…



Local influence 0.4



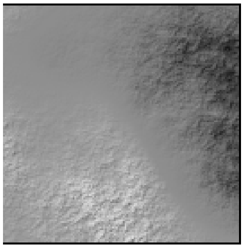
Local influence 0.6



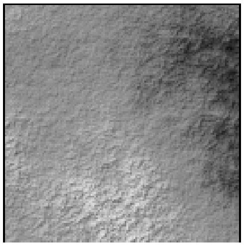
Local influence 1.0

Creep in: this parameter controls how much of the original roughness gets mixed back into the local roughness at each iteration. Higher values mean that the variable roughness only affect a few harmonics.

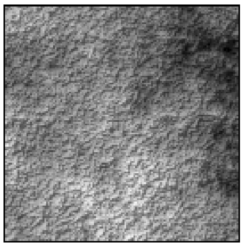
...Studio, Producer...



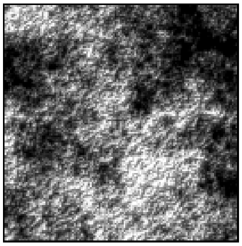
Creep in 0



Creep in 0.02



Creep in 0.1



Creep in 0.5

…Studio, Producer

Variable Noise Fractal

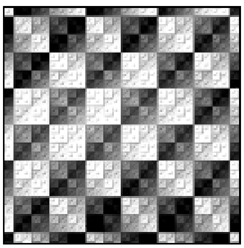
Studio, Producer…

This type of fractal is able to vary its base noise according to altitude. The first noise is used to compute the first iteration. Subsequent iterations are computed by blending the two types of noise according to altitude: the first type of noise will appear at lower altitudes, whereas the second type of noise will appear at higher altitudes. Variable Noise Fractals create very subtle variations in the surface properties. They are however very slow to compute.

Noise 1: this is the same as the base noise setting common to all fractals.

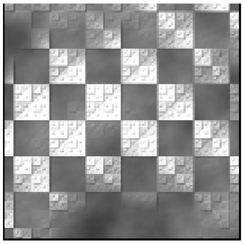
Noise 2: this drop-down menu lets you select the second noise to be applied at higher altitudes. You can edit the noise properties by pressing the Edit button.

Switch level: this parameter is similar to the smooth level parameter of Variable Roughness fractals (see above). It controls the point at which the fractal switches its noise. If the altitude is below the switch level, the fractal will use the first noise. If the altitude is higher than the switch level, the fractal will use the second noise. Around the switch level, the two noises are blended according to the altitude.

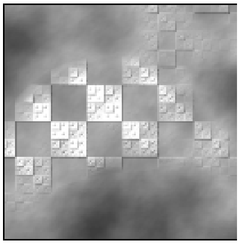


...Studio, Producer...

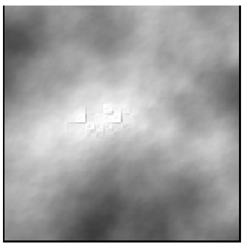
Switch level -1



Switch level 0

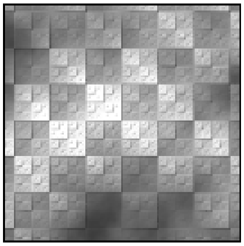


Switch level 0.2



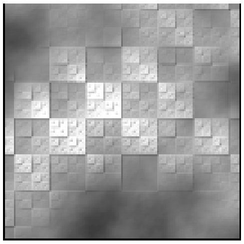
Switch level 0.5

Switch speed: controls the speed at which the fractal switches noise around the switch level.

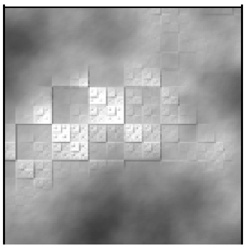


...Studio, Pro- ducer...

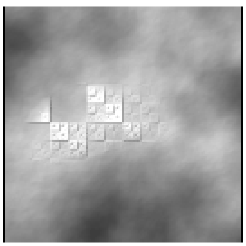
Switch speed 0.1



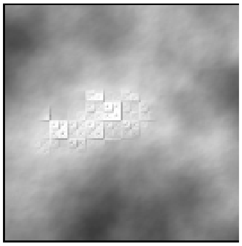
Switch speed 0.2

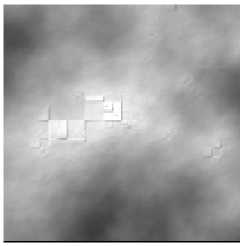


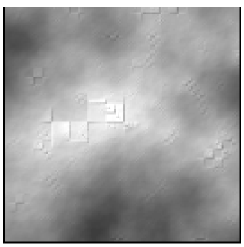
Switch speed 0.5



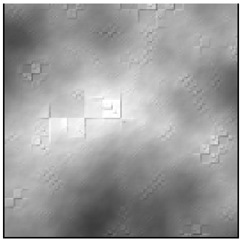
...Studio, Pro- ducer...







Local influence 0.75



Local influence 1

...Studio, Producer

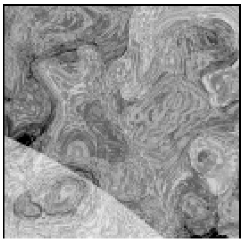
Three Noise Fractal

Studio, Producer...

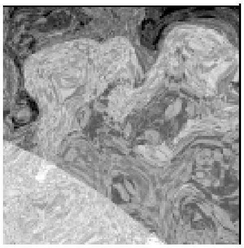
This is a complex fractal that mixes different noises according to the scale of the noise. It also lets you control the fractal's roughness in the same way as the Variable Roughness fractal.

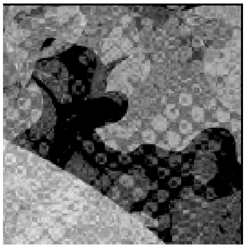
Variable roughness: all the settings in this group behave as the Variable Roughness fractal's settings.

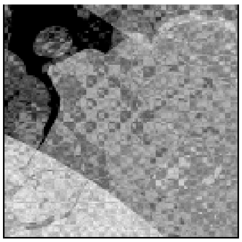
Turbulence damping: this setting controls the influence of the turbulence (origin shift) according to the harmonic. If set to 0, turbulence will be applied to all harmonics the same. The higher the value, the less harmonics that are affected by the turbulence – only large scale patterns are affected by the turbulence.

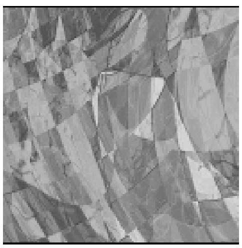


...Studio, Producer...



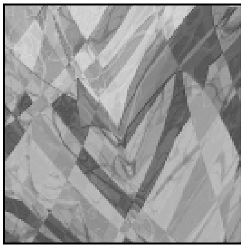




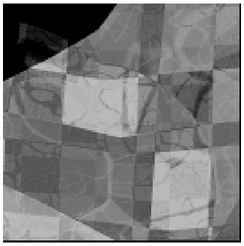


Damping 0

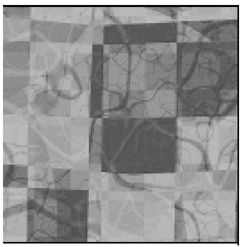
...Studio, Producer...



Damping 0.15



Damping 0.4



Damping 0.5

Mid-scale noise: this is the second noise to be used by the fractal when the scale becomes less than the change-over setting below.

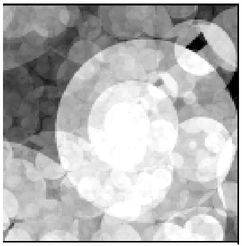
Change-over scale: this is the scale below which the fractal switches it's base noise to the mid-scale noise.

Small-scale noise: this is the third noise to be used by the fractal when the scale gets very small and becomes less than the small-scale change-over setting below.

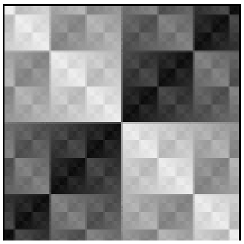
Change-over scale: this is the scale below which the fractal switches it's base noise to the small-scale noise.

...Studio, Producer...

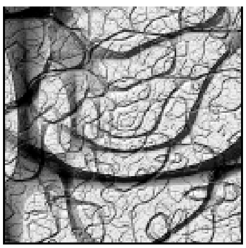
In the examples below, we will use the following noises:



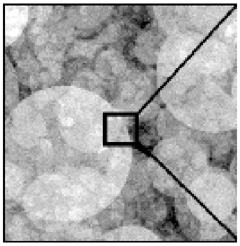
Large scale noise: Water cress



Mid scale noise: Rectangular Change over scale = 8

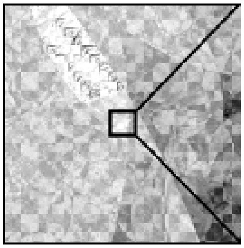


Small scale noise: Sparse cracks Change over scale = 2

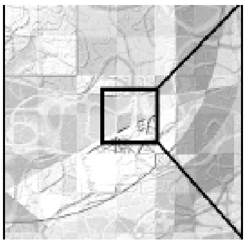


...Studio, Producer...

Zoom 0: water cress noise is mostly visible



Zoom x8: some small rectangles from rectangular noise start appearing



Zoom x80: mostly patterns from the rectangular noise, but the sparse cracks are starting to show up

…Studio, Producer

Zoom x300: at large zoom levels, the sparse cracks noise dominates

Open Ocean

Studio, Producer…

The Open Ocean node is a simple simulation of open ocean water surfaces. It will create a nice simulation of the surface of the water, but it will not take into account any surrounding objects – hence the name. This node works best when used to produce the altitude function of a procedural terrain. By assigning a “World – Standard” mapping mode to the terrain and resizing the terrain in the Top view so that it fills up the entire world will yield very nice “infinite” ocean surfaces.

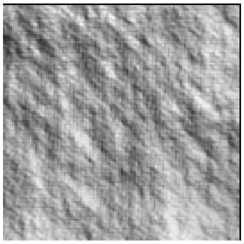
This node is not a fractal per se, because the shape of the waves is different depending on the size of the wave, and there is a wave size under which the waves stop appearing (due to water surface tension). However, at larger scales, it does exhibit a somewhat fractal behavior, hence its classification in this category.

Unlike other fractal nodes, the Open Ocean node does not use a base noise to create water patterns. The “With rotation” and “Roughness” parameters do not exist either. Because this node takes all of its parameters into account to create a simulation that is as accurate as possible, the actual “roughness” of the water surface is controlled through other settings:

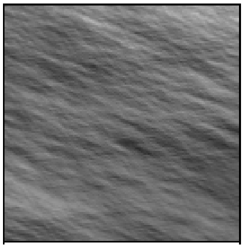
Wind direction: this parameter controls the direction in which the wind is blowing, as seen from above (the azimuth). A value of zero will make the wind blow from left to right in Top view. A value of 90° will make the wind blow from top to bottom in Top view. There is no relationship between this wind setting and the wind or breeze effects applied to plants.

Intensity: this parameter controls the intensity of the wind. Higher values will realistically lead to higher waves and rougher water surfaces.

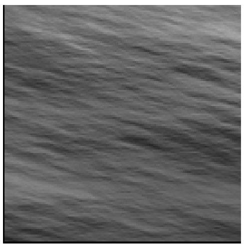
...Studio, Producer...



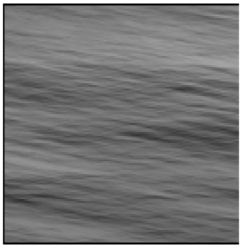
Wind intensity 0



Wind intensity 0.7



Wind intensity 1

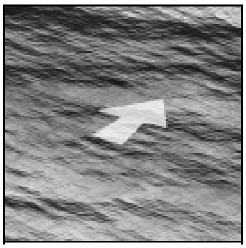


...Studio, Pro-ducer...

Wind intensity 2

Wave agitation tweak: this parameter lets you adjust the overall velocity of the waves created by the Open Ocean node. Its effects are only visible in animations. Values greater than 1 will make the waves move faster at the surface of the water, while values less than 1 will slow down the waves.

Foam output: when you connect to the Open Ocean node, you get the choice between Altitude and Foam outputs. The Foam output represents the typical foam density at the top of waves, and can be exported for use in the Material Editor to realistically distribute foam on the water.

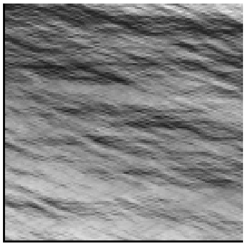


Agitation tweak = 0.2 waves move slowly in animations

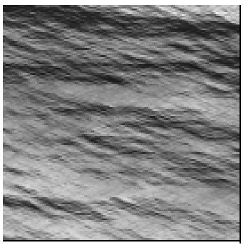
...Studio, Producer...

Agitation tweak = 2: waves move quickly in animations

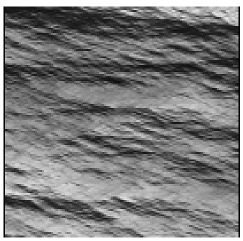
Choppiness: this parameter controls the shape of the waves. Small values will yield soft round waves, whereas high values will produce choppy waves that are sharp at their top.



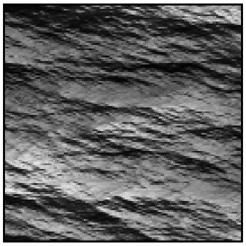
Choppiness 0



Choppiness 0.5

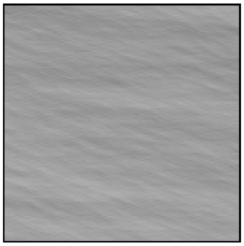


Choppiness 0.7

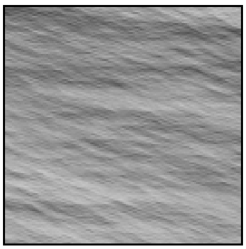


Choppiness 1

Gain: like with other fractal nodes, this parameter lets you adjust the altitude of the waves without interfering on the other settings of the simulation. It is generally recommended that you leave this value to the default value of 1 as this creates a realistic water simulation. This parameter may however come in useful, for instance if you have resized the supporting procedural terrain vertically.



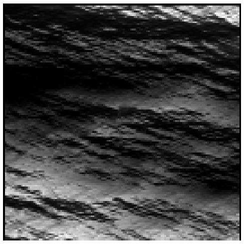
Gain 0.3



Gain 1

...Studio, Producer

Gain 0.2



Gain 10

Math Nodes

Studio, Producer

The math nodes present utility operations that are not used in everyday graphs.

Conversions

Studio, Producer...

Vector To RGB

This node receives a vector and outputs a color where the red component is equal to the value of the vector along the X axis, the green component is equal to the value of the vector along the Y axis, and the blue component is equal to the value of the vector along the Z axis.

RGB To Vector

This node receives a color and outputs a vector where the value of the vector along the X axis is equal to the red component of the input color, the value of the vector along the

Y axis is equal to the green component of the input color, and the value of the vector along the Z axis is equal to the blue component of the input color.

...Studio, Producer

RGB To HLS

This node is useful to convert colors from the Red-Green-Blue paradigm to the Hue-Luminosity-Saturation paradigm. It receives a color and outputs a vector where the value of the vector along the X axis is equal to the hue of the input color, the value of the vector along the Y axis is equal to the luminosity of the input color, and the value of the vector along the Z axis is equal to the saturation of the input color.

HLS To RGB

This node does the exact opposite of the previous one. It converts colors from the Hue-Luminosity-Saturation paradigm to the Red-Green-Blue paradigm. It receives a vector containing the HLS data and outputs a color based on that HLS data.

Color To Brightness

This simple converter node returns the brightness of the input color.

Vector Operations

Studio, Producer...

Offset

This node simply adds an offset to the input vector.

Offset: defines the vector that will be added to the input vector.

Rotation And Twist

This node applies a rotation and twist transformation to the input vector.

Transformation: click on the Edit button to open the Transformation Editor. This dialog lets you indicate a rotation angle around each of the world axes, as well as a twisting angle of these axes one towards another.

Projection

This node transforms the input vector into the requested coordinate system.

Projection type: this drop-down list box lets you select the projection type of the node:

- **Cylindrical**: if this option is selected, the input vector will be converted to the cylindrical coordinate system.
- **Spherical**: if this option is selected, the input vector will be converted to the spherical coordinate system.

…Studio, Producer…

Matrix Transformation

This node lets you apply a user transformation matrix to the input vector.

Line 1..3: these 3 vector parameters specify the transformation matrix that will be applied to the input vector.

Decomposer

The Decomposer node takes a vector as input and outputs a number. It splits the input vector into 3 possible outputs that correspond to each one of the input vector's components. When you attempt to connect a link to a decomposer node, a popup menu will appear so that you can select the desired component.

Composer

The Composer node does just the opposite of the Decomposer node: it takes 3 numbers as inputs and outputs a vector constructed from these 3 inputs.

Length

This simple node takes a vector as input and returns a number representing the length of the vector.

Normalize

This node takes a vector as input and returns a vector pointing in the same direction, but with a length of exactly 1.

Dot Product

This node takes two vectors as inputs and returns a number corresponding to the dot product of both vectors. If the two vectors are normalized, the dot product is equal to the cosine of the angle between the two vectors. If the vectors point in exactly the same direction, the dot product is equal to 1, if they point in exactly opposing directions, it is -1, and if the two vectors are at right angles one with the other, it is 0.

Vector Product

...Studio, Producer...

This node takes two vectors as input and returns a vector that is the result of the vector product of the two input vectors. The result of the vector product is a vector that is at right angles with both of the input vectors.

Vector Quantization

Vector Quantization is a process where an input 3D vector is transformed into another one by choosing among a discrete subset of 3D space.

This is implemented by partitioning the input space in "cells", choosing a privileged point in each cell, and always returning this specific point instead of the input vector when the input falls inside the cell.

To allow for a wider range of effects, this node implements a kind of smoothing of the resulting vector for some subset of parameters (see detailed description below) for which the input vector will not be fully "snapped" to the privileged point, but only attracted by it to some extent.

Two cell partitions are currently implemented. Not all parameters shown apply to both partitions. Unavailable parameters are grayed out so as to avoid confusion.

Parameters

Origin: this parameter acts as an offset on the cell pattern applied on the input space. Only the pattern is affected; the output vector is not itself offset and will always be close to the input value (closeness depending only on cell sizes).

Scaling: this parameter acts on the size of cells along each of the X, Y, Z axis. Higher values mean bigger cells.

Quantization shape

Regular cells: these cells have a shape ranging from circular (influence = 0) to square (influence = 1), with all intermediate "rounded square" shapes in between. Smoothing is always applicable, even with an influence of 1. **Voronoi cells**: these cells have an irregular polygonal shape and very different sizes. Influence defines the thickness of a border between cells, in which only partial attraction applies on the input vector. Smoothing only applies inside this border, ie. there can be no smoothing with an influence of 1.

Influence: this parameter defines how a cell's privileged point attracts the input vectors falling inside the cell. Its exact meaning depends on the cell pattern used.

…Studio, Producer

Smooth transition: this parameter defines how smooth is the transition between the invariant and attracted areas.

Number of cells to consider: this parameter only applies to Voronoi cells. It can be used to augment variety of the cellular partitioning by considering overlaps of 2 or more cells as distinct cells in themselves. On the other hand, influence and smoothing cannot apply when considering cell overlaps.

By blending the result with a non-quantized version of the same fractal, one can localize the effect following some pattern, eg. by driving the blending with another noise.

By adding a turbulence to the input vector, the cell pattern will also be affected, which means it is very easy to obtain irregular cell borders, which is even more interesting than a simple quantized-input fractal.

Other Math Nodes

Studio, Producer…

Sine

Returns the sine of the input number.

Input as degrees: if checked, this option indicates that the input value is in degrees rather than radians.

Arc Cosine

Converts the input number into a number who's cosine is the input value.

Output as degrees: if checked, this option indicates that the output value is in degrees rather than radians.

Floor

Returns the round number that is just below the input number.

Fractional Part

The fractional part is the part of the number after the dot. It's equal to the number less the Floor of the input number.

Invert

This node inverts the input number (returns 1/x).

Power

…Studio, Producer

This node returns the first input raised to the power of the second input.

Square Root

This node returns the square root of the input number.

Multiply

This node multiplies its two inputs together.

Noise Nodes

Studio, Producer

Common Parameters

Studio, Producer

Scale

The scale parameter is a number that controls the overall scale of the noise. Larger values mean that the noise pattern looks larger. This parameter works in conjunction with the Wavelength parameter to determine the final scale of the noise along each axis.

Wavelength

Whereas the scale parameter only lets you control the size of the noise pattern globally, the Wavelength parameter is a vector parameter that lets you adjust the scale of the noise along each axis. For instance, if you want the noise to vary only along the Z axis, enter 0 in the X and Y wavelengths.

Origin

The origin parameter is a vector that indicates the point at which the noise originates. By modifying this value, you can shift the noise pattern around. If you plug the Origin parameter into a Turbulence node, you will add turbulence to the noise.

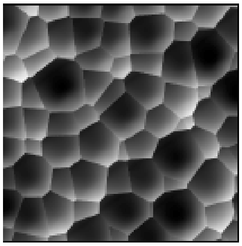
Cellular Patterns

Studio, Producer…

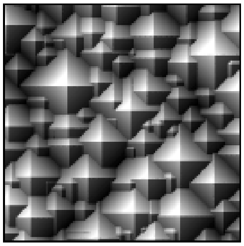
A cyclic version of **Cellular Patterns** is available. Refer to the previous section for more information.

Chipped, Crystals, Pebbles

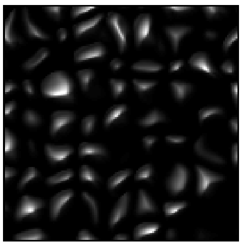
…Studio, Producer…



Chipped noise



Crystal noise

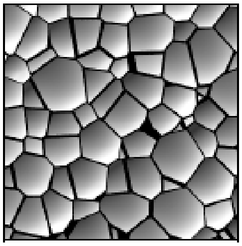


Pebble noise

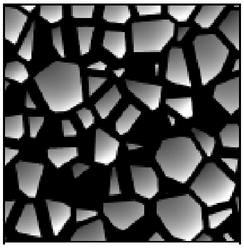
These nodes do not define any additional parameters.

Drought

Crack width



Default



0.25

This noise looks like the patterns created by wet soil that has dried out.

Crack width: controls the width of the cracks.

Voronoi

Voronoi noises produce patterns that are based on the distance to randomly positioned seed points on a grid.

Neighbor mode: determines what distance is taken into account to produce the noise pattern:

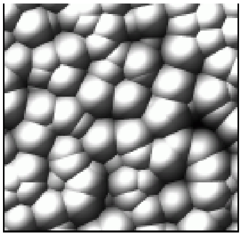
- **Closest neighbor**: the shortest distance to a neighboring seed point,
- **2nd closest neighbor**: not the shortest distance, but the 2nd shortest,
- **3rd closest neighbor**: not the shortest distance, but the 3rd shortest,
- **4th closest neighbor**: not the shortest distance, but the 4th shortest,
- **1st–2nd neighbors**: distance to the closest neighbor minus distance to the 2nd closest,

…Studio, Producer…

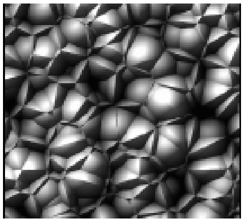
- **2nd–3rd neighbors**: distance to the 2nd closest neighbor minus distance to the 3rd closest,
- **3rd–4th neighbors**: distance to the 3rd closest neighbor minus distance to the 4th closest,

…Studio, Producer…

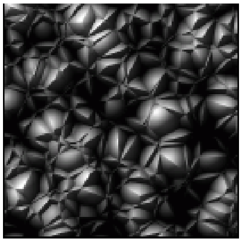
Closest neighbor



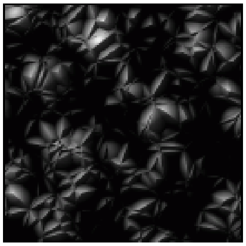
Closest neighbor default



2nd closest neighbor

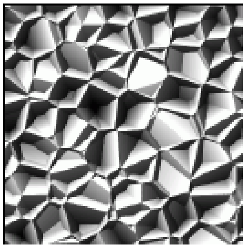


3rd closest neighbor

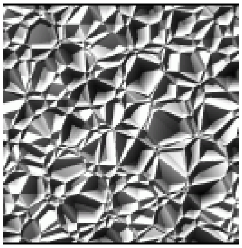


4th closest neighbor

difference between consecutive closest neighbors

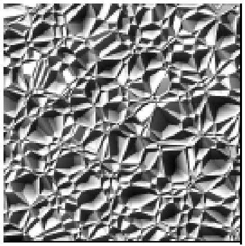


1st minus 2nd



2nd minus 3rd

…Studio, Producer…

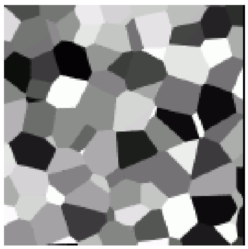


3rd minus 4th

…*Studio, Producer*…

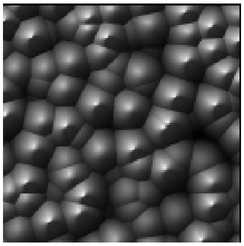
Voronoi profile: determines the curvature of the noise over a fragment as the distance increases:

- **Flat**: creates fragments of uniform value, the distance to the closest neighbor being used on the entire fragment,
- **Spikes**: the noise amplitude varies linearly with the distance, creating pointy shapes,
- **Angles**: a little more rounded than spikes,
- **Round**: yet a little more rounded,
- **Smooth rounded**: the most rounded Voronoi profile.

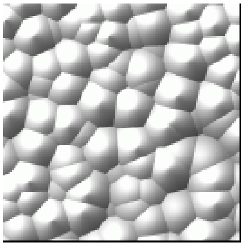


Flat

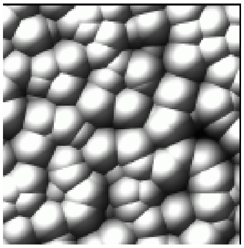
...Studio, Producer...



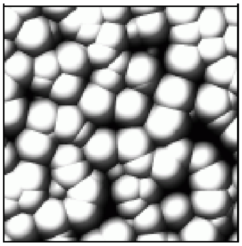
Spikes



Angles



Rounded (default)



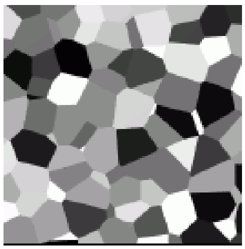
…Studio, Producer…

Smooth rounded

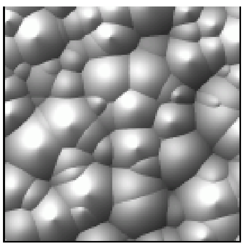
Voronoi (Altitude)

Basically the same as the above Voronoi noise, except that the altitudes of the different fragments varies randomly. The Voronoi Altitude Flat noise is identical to the Voronoi Flat noise. You cannot select the neighbor mode for this type of Voronoi.

Voronoi profile: same as above.

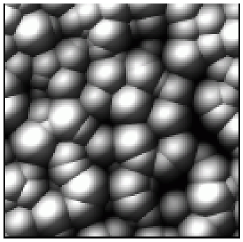


Flat

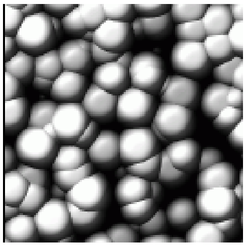


Spikes

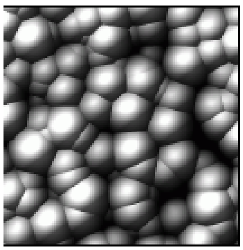
...Studio, Producer...



Angles



Rounded (default)



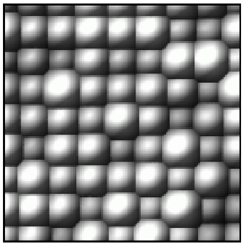
Smooth rounded

Voronoi (Generalized)

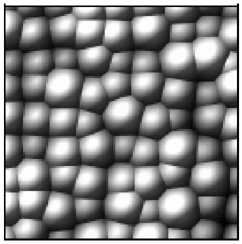
The generalized Voronoi noise is yet another variation of the Voronoi noises where the curvature of the fragments is adjustable continually, and where you can adjust the amount of randomness in the size of the fragments.

Randomness: controls the amount of randomness in the size and shape of the different fragments that constitute the noise pattern. If 0 randomness is entered, the fragments will all be square.

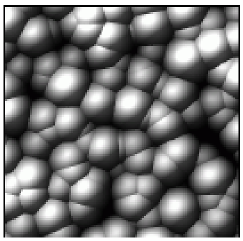
Randomness



0

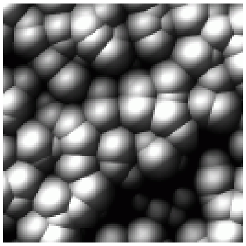


0.2



0.5

…Studio, Producer…

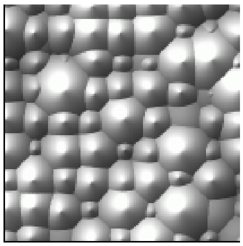


…Studio, Producer…

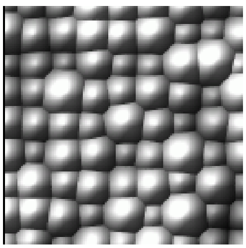
1

Voronoi profile: this controls the curvature of the fragments. It is similar to the Voronoi type described above, except that it lets you vary the curvature continuously.

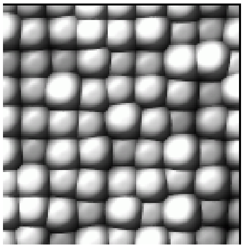
Randomness



1

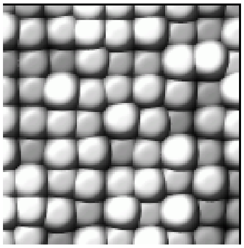


1.25



…Studio, Producer

1.75



2

Distributed Patterns

Studio, Producer…

These types of noises create a pattern by scattering a basic shape randomly in noise space. Warning: these types of noise are very slow to compute. Use the 2D counterparts wherever possible. A cyclic version of **Distributed Patterns** is available.

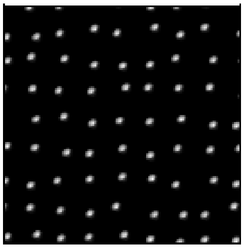
Round Samples and Round Samples (2D)

Distributes round patterns. These two noises are very similar. The only difference between the two noises is that the second version only scatters the patterns along the X and Y axes, resulting in much quicker evaluation (which is especially useful for procedural terrains).

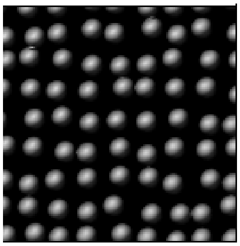
Size: controls the average size of the patterns.

Size

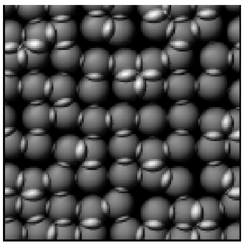
...Studio, Producer...



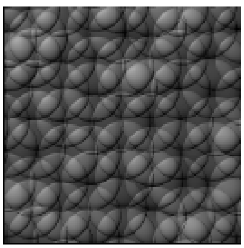
0.2



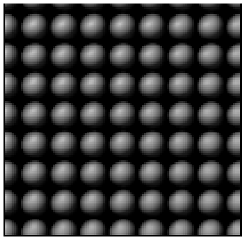
0.4

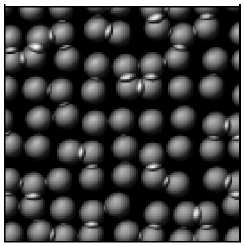


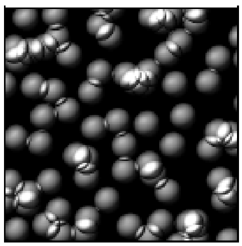
0.6

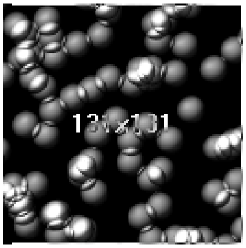


...Studio, Producer...









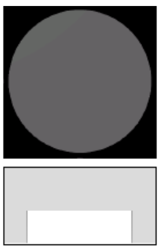
...Studio, Producer...

1

Shape: controls the shape of the patterns in terms of altitude:

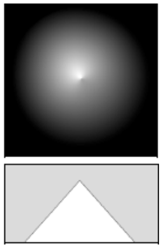
- **Cylinder**: the altitude of the pattern is constant all over its surface; the noise scatters tiny cylinders in noise space,
- **Cone**: the altitude of the pattern varies linearly with the distance to the center of the pattern; the noise scatters tiny cones in noise space,
- **Round**: the noise scatters hemispheres in noise space,
- **Smooth round**: the noise scatters little round bumps that connect smoothly with the underlying geometry,
- **Cone tower**: same as cone, except the cones are placed on tiny cylinders,
- **Round tower**: same as round, except the hemispheres are atop tiny cylinders.

Shape

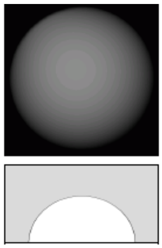


Cylinder

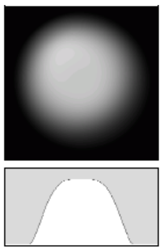
…Studio, Producer…



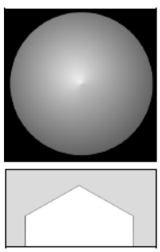
Cone



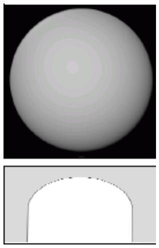
Round



Smooth round



...Studio, Producer...



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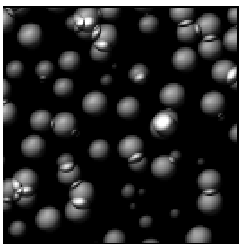
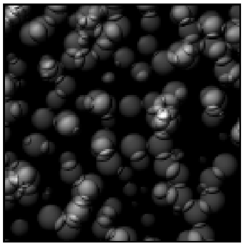
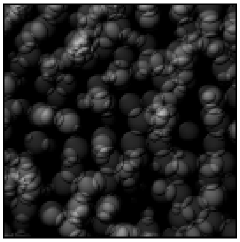


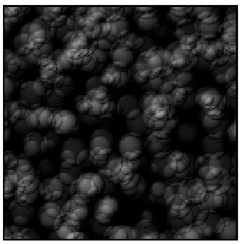
...Studio, Producer...



2



3

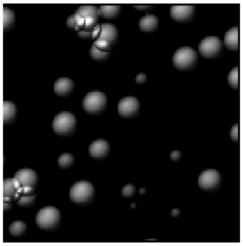


4

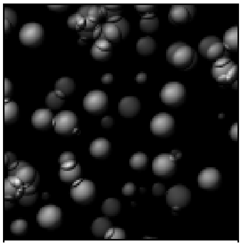
- **0 to 1 samples per cell**: each cell will contain a maximum of 1 pattern, maybe none,
- **0 to 2 samples per cell**: each cell will contain anything from 0 through 2 patterns,
- **0 to 3 samples per cell**: each cell will contain anything from 0 through 3 patterns,
- **0 to 4 samples per cell**: each cell will contain anything from 0 through 4 patterns,

…Studio, Producer…

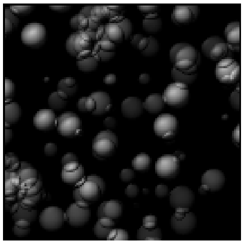
Range of samples per cell



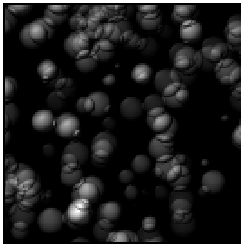
0 to 1



0 to 2



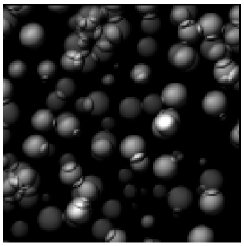
0 to 3



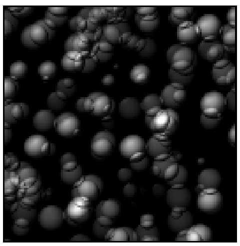
0 to 4

- **1 to 2 samples per cell**: each cell will contain either 1 or 2 patterns,
- **1 to 3 samples per cell**: each cell will contain anything from 1 through 3 patterns,
- **1 to 4 samples per cell**: each cell will contain anything from 1 through 4 patterns,

Range of samples per cell



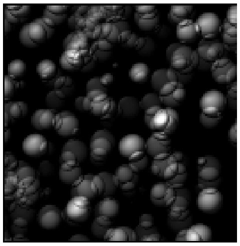
1 to 2



1 to 3

…Studio, Producer…

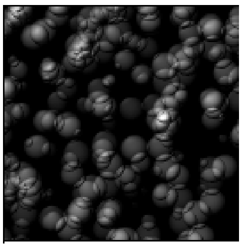
…Studio, Producer…



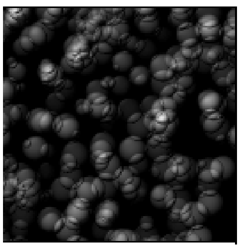
1 to 4

- **2 to 3 samples per cell**: each cell will contain either 2 or 3 patterns,
- **2 to 4 samples per cell**: each cell will contain anything from 2 through 4 patterns,
- **3 to 4 samples per cell**: each cell will contain anything from 3 through 4 patterns,

Range of samples per cell

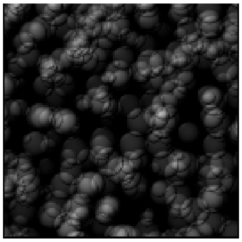


2 to 3



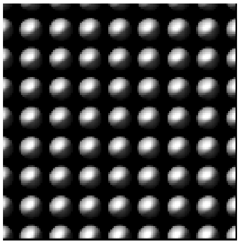
2 to 4

…Studio, Producer…

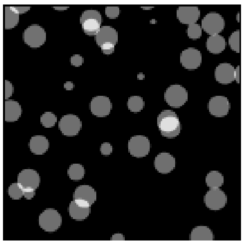


3 to 4

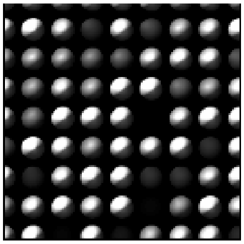
Random altitudes: this option, when checked, will assign a random altitude to each pattern.



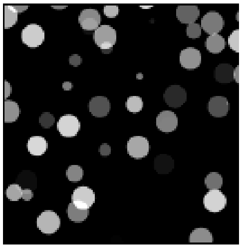
Without random altitudes



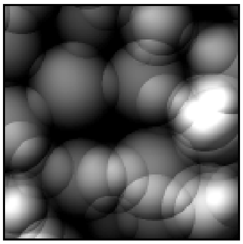
...Studio, Producer...



With random altitudes

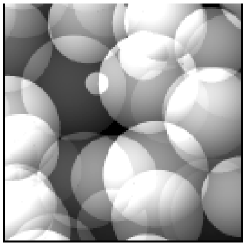


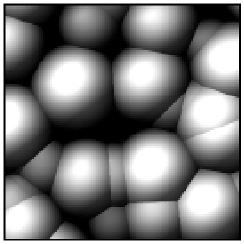
Find maximums: if this option is checked, the noise will find the maximum of all the patterns that overlap the point of evaluation of the noise.



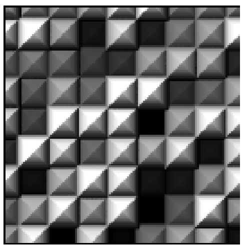
Without find maximums

...Studio, Producer...





With find maximums

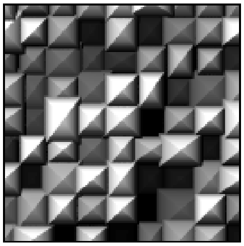


Square Samples and Square Samples (2D)

These noises are similar to the Round Sample noises, except they map square patterns instead of round patterns.

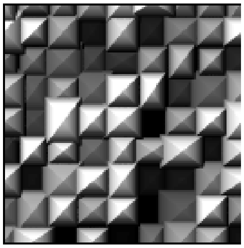
Size: same as the Round Samples noise. **Randomness**: same as the Round Samples noise. **Scale variations**: controls the amount of variation in the aspect ratio of the square patterns. If 0, all patterns will be square. If non zero, the patterns will be more or less stretched.

Scale variation

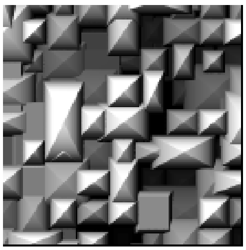


...Studio, Pro- ducer...

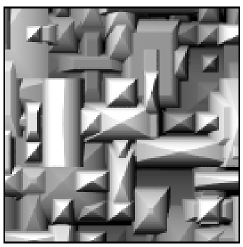
0



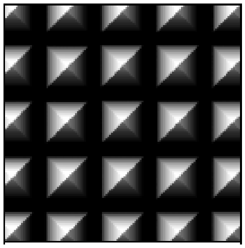
0.3

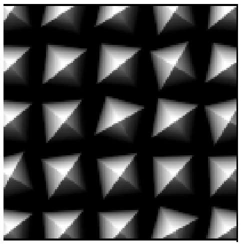


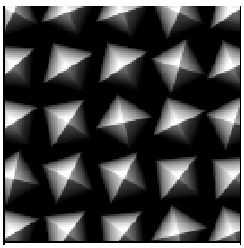
0.6



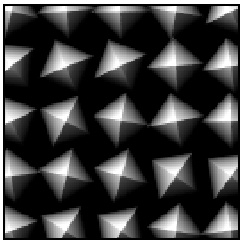
...Studio, Producer...







0.6

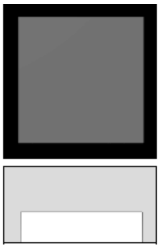


1

Shape: similar to the shape parameter of the Round Samples noise, except applied to square patterns:

- **Cube**: the noise scatters little cubes in noise space,
- **Pyramid**: the noise scatters little pyramids in noise space,
- **Round pyramid**: the noise scatters pyramids that have a rounded profile in noise space,
- **Pyramid tower**: same as pyramid, except the pyramids are placed atop little cubes,
- **Round pyramid tower**: same as round pyramid, except the round pyramids are placed atop little cubes.

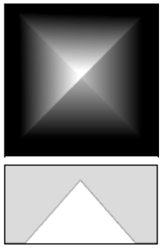
Shape



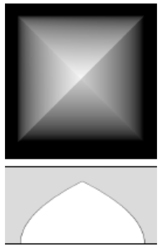
Cube

…Studio, Producer…

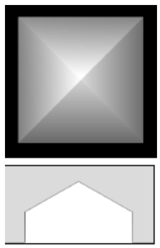
…Studio, Producer…



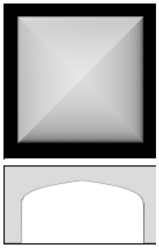
Pyramid



Round pyramid



Pyramid tower



...Studio, Producer

Round pyramid tower

Samples: same as the Round Samples noise. **Random altitudes**: same as the Round Samples noise. **Find maximums**: same as the Round Samples noise.

Flat Patterns

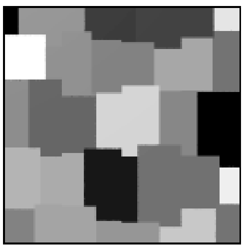
Studio, Producer...

The noises in this category create flat patterns. They don't work so well for bumps, because they tend to create sharp edges. There are noises in other categories that also produce flat patterns. A cyclic version of

Flat Patterns is available.

Varying Blocks, Clumps, Water Cress

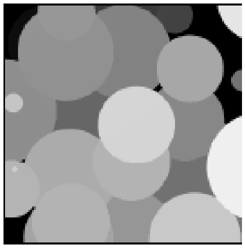
These noises do not define any additional parameters.



Varying Blocks

…Studio, Producer

Blocks



Water Cress

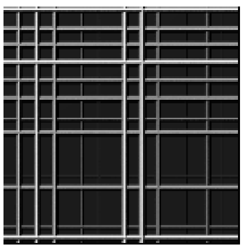
Line Patterns

Studio, Producer…

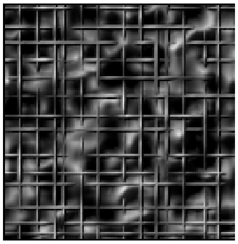
The noises in this category create patterns that are mostly based on lines. A cyclic version of **Line Patterns** is available.

Lines, Fabric

These noises do not define any additional parameters.



...Studio, Producer...

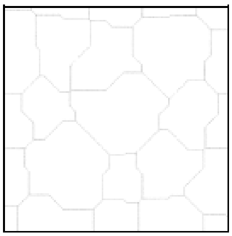


Lines

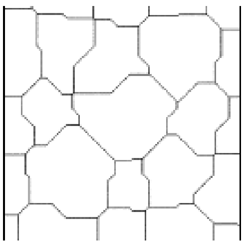
Fabric

Cracks

Crack width: controls the width of the cracks.

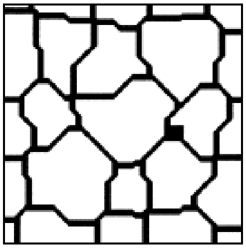


Crack width = 0.01

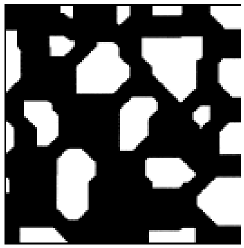


Crack width = 0.03

...Studio, Producer...



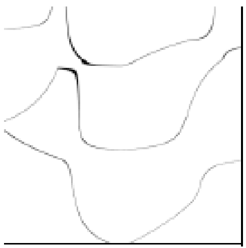
Crack width = 0.20



Crack width = 0.70

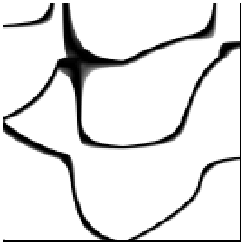
Sparse Cracks

Crack width: controls the width of the cracks.

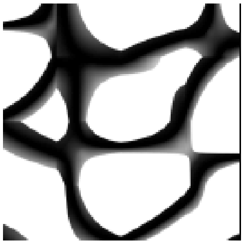


Crack width = 0.01

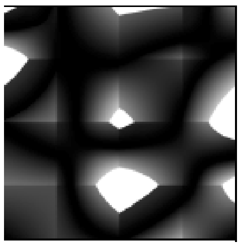
...Studio, Producer



Crack width = 0.05



Crack width = 0.20



Crack width = 0.80

Math Patterns

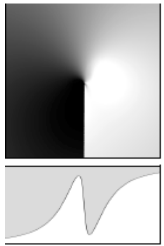
Studio, Producer...

The noises in this category define simple patterns based on mathematical functions. They are mostly used to combine other noises together or create special patterns that require the regularity of mathematical functions.

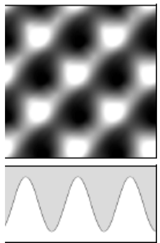
Onion, Wavelet, Step (Vertical), Step (Gradual), Tooth (Rectangular), Tooth (Triangular), Tooth (Gaussian), Radial Sine, Sine Wave, Triangular Wave, Leopard, Saw Teeth, Water Wave

…Studio, Producer…

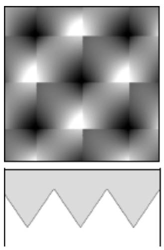
These noises do not define any additional parameters.



Radial sine

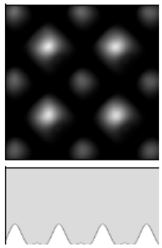


Sine wave

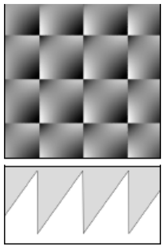


Triangular

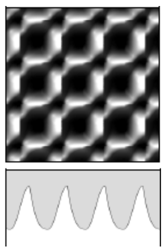
…Studio, Producer…



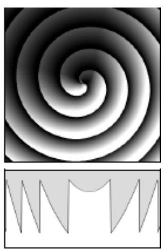
Leopard



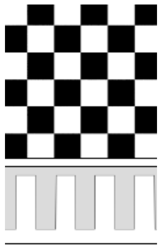
Saw teeth

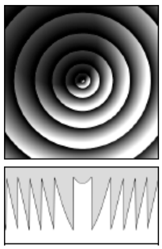


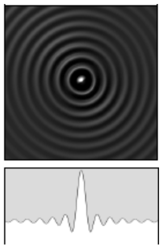
Water wave



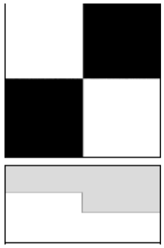
…Studio, Pro-ducer…



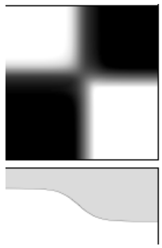




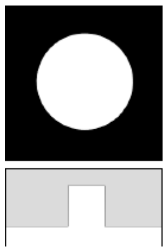
...Studio, Producer...



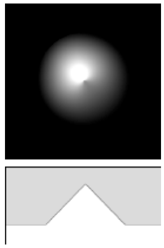
Step rectangle



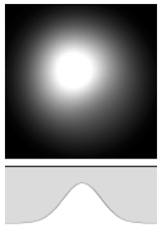
Step (smooth)



Tooth (rectangular)



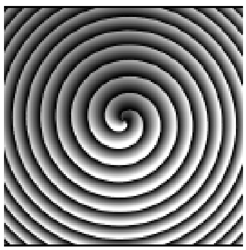
Tooth (triangular)



Tooth (gaussian)

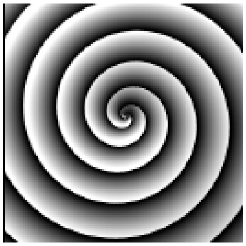
Spiral

Radial expansion: if checked, this option will make the wavelength of the spiral pattern increase as it moves away from its origin.



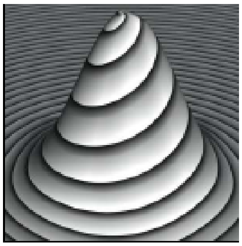
Without radial expansion

...Studio, Producer...

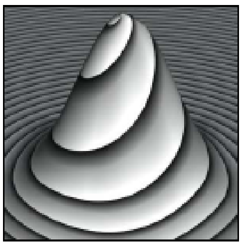


With radial expansion

Vertical warp: if set, this option indicates that the phase of the spiral changes with the altitude.



Without vertical warp

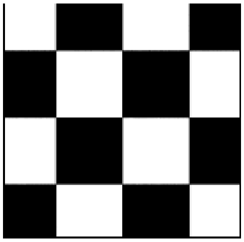


With vertical warp

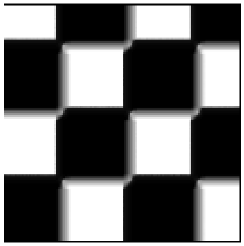
Rectangular Wave

Step width: controls the steepness of the transitions between low and high values. 0 means perfectly vertical edges.

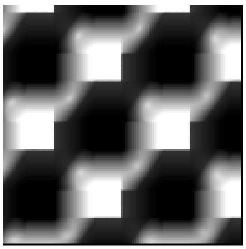
…Studio, Pro- ducer…



Step width = 0

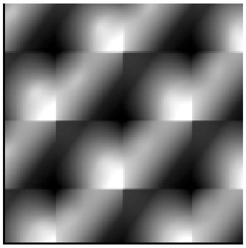


Step width = 0.1



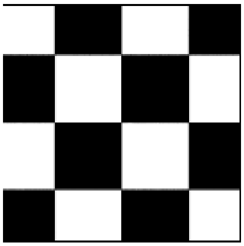
Step width = 0.3

...Studio, Producer...

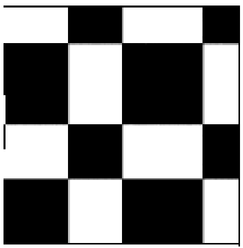


Step width = 0.5

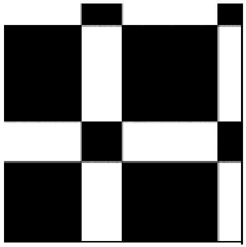
Up/down ratio: controls the size of the patterns when the output is high (up) versus when it is low (down). Similar to the pulse width. This parameter only has an effect if the step width is non zero.



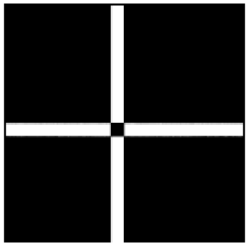
Up/down ratio = 0.5



Up/down ratio = 0.6



Up/down ratio = 0.7



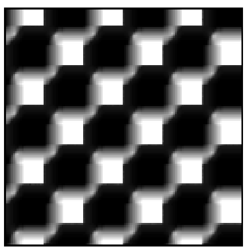
Up/down ratio = 0.9

Slope: controls which transitions are done abruptly and which ones are done smoothly. This parameter only has an effect if the step width is non zero.

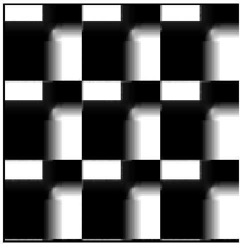
Slope up and down: if the step width parameter is non zero, both transitions from up to down and from down to up will be gradual.

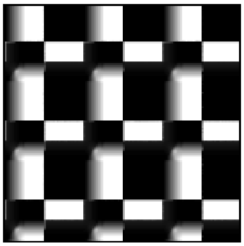
Slope up only: only transitions from down to up will be gradual. Transitions from up to down will be abrupt.

Slope down only: only transitions from up to down will be gradual. Transitions from down to up will be abrupt.



...Studio, Producer



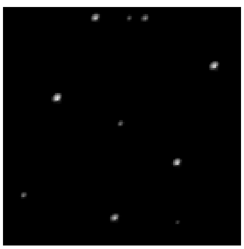


Other Patterns

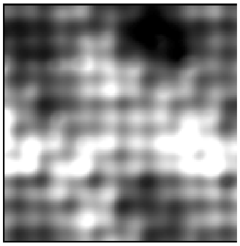
Studio, Producer...

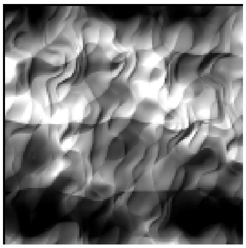
Dots, Water (Calm), Water (Rough), Granite

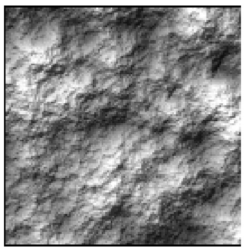
These noises do not define any additional parameters.



...Studio, Producer







Studio, Producer...

Perlin Noises

...Studio, Producer...

Noises in this category are all based on work by Ken Perlin. They produce repeatable patterns that look random and are the basis to most procedural textures.

There are 3 types of basic Perlin noises: Linear, Value and Gradient. Linear Perlin produces sharp edges, Value is a slightly better but slower version of the Perlin noise, and Gradient is the best (and also slowest version). Each type of Perlin noise has its pros and cons in terms of looks. A cyclic version of **Perlin Noises** is available.

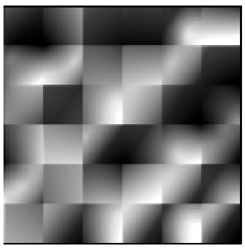
Common Parameter

Ridged: this option creates ridges in the noise pattern. It also has the side effect of making the noise higher on average.

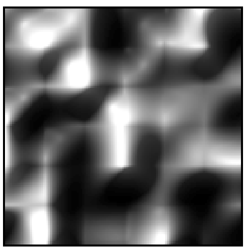
Animated: when this option is selected, the noise will be evaluated in 4 dimensions instead of 3, the fourth dimension being that of time. This will result in a noise that produces patterns that change over time. Whenever you select this option, a link will be automatically established with the "Time" input.

Linear, Value, Gradient

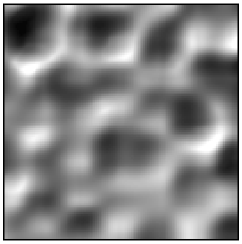
The basis Perlin styles of noises. No additional parameters – aside from the Ridged option – are defined for these noises.

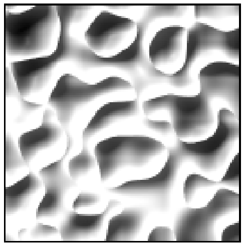


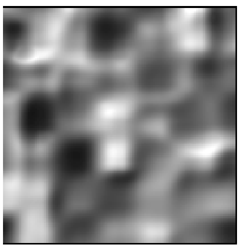
Linear



...Studio, Producer...

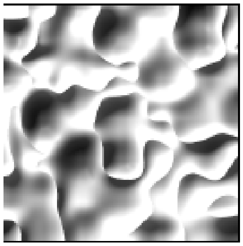




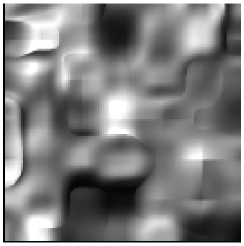


...Studio, Producer...

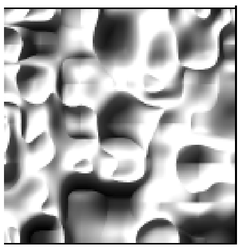
Value-Gradient (variable)



Value-Gradient (variable) + Ridged



Linear-Value-Gradient (variable)



Linear-Value-Gradient (variable) + Ridged

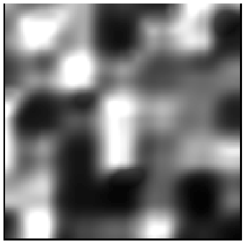
Value-Gradient, Linear-Value-Gradient

These two noises are combinations of the base Perlin noises. The different types of noises are blended according to the Ratio setting.

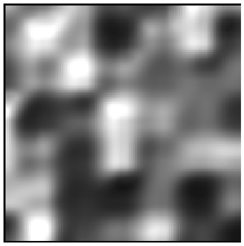
...Studio, Producer...

Ratio: controls the proportion of each type of Perlin noise in the final noise.

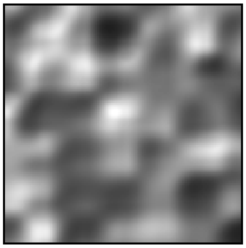
Value-gradient: Ratio



0

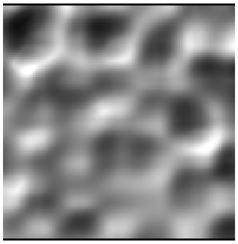


0.2



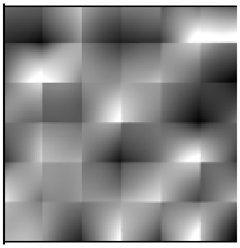
0.5 (default)

…Studio, Producer…

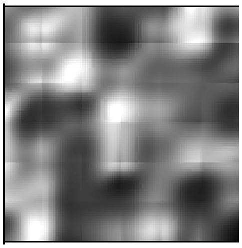


0.9

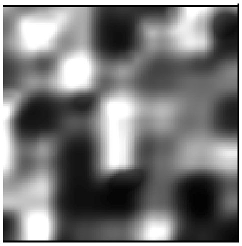
Linear value-gradient: Ratio



-0.9

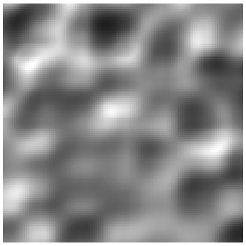


-0.3



…Studio, Producer

0 (default)



0.7

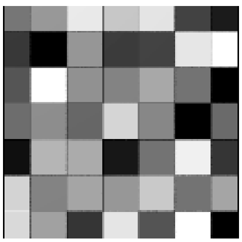
Square Patterns

Studio, Producer…

A cyclic version of **Square Patterns** is available.

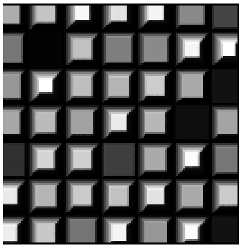
Random Altitudes, Squares, Squares (Pairs), Stones, Square Blobs, Square Stones

These noises do not define any additional parameters.

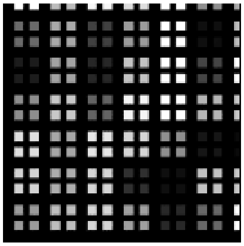


...Studio, Producer...

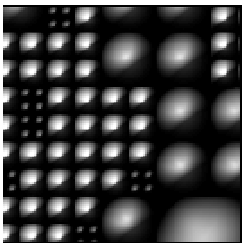
Random Altitudes



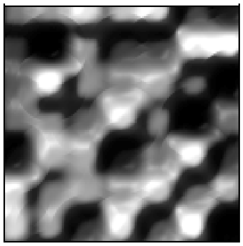
Squares



Squares (pairs)

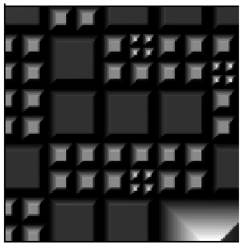


Stones



...Studio, Producer

Square blobs



Square stones

Texture Map Nodes

Studio, Producer

Mapping Nodes

Studio, Producer...

Texture Map

The Texture Map node is used to map a picture onto objects. Its input is a texture coordinate, and the texture map node returns the color of the pixel in the texture map that is at the point indicated by the texture coordinate.

When you create a Texture Map node, SmartGraph automatically creates a "UV Coordinates" node and connects it to the node's input. You can use the "UV Coordinates" node to define how the picture is mapped onto the object (see below for details on the "UV Coordinates" node).

Texture map nodes can be made to output any of the following values:

- **Color output:** the color of the pixel in the texture map that is at the point indicated by the texture coordinates.
- **Grayscale output:** the color of the pixel converted to a grayscale value.
- **Alpha output:** the alpha value corresponding to that pixel (if the point is inside the image, or 0 if it is outside the image).

...Studio, Producer...

When you connect a node to the output, a popup menu will appear so that you can select the desired type of output.

- **Image:** double-click on the image preview to load a new picture to be used as texture map. You can rotate the picture by increments of 90° using the and buttons. If you need to invert the values, you can do so by pressing the button.
- **Image offset:** the image can be positioned precisely by using these parameters. These will shift the image around the origin (in pixel units).
- **Interpolation type:** interpolation is used to reduce the pixelization effect when the texture map is seen from very close and the resolution of the map is insufficient. These interpolation methods are the same as that of the mapped picture material coloring mode.
- **Tiling mode X:** this is a drop-down list that lets you select the way the image is repeated along the X axis. Possible values are the same as that of the mapped picture material coloring mode.
- **Tiling mode Y:** this is the same as the above, only along the Y axis.

Note:

Images mapped using the Texture map node are not mip-mapped. If you would like to enable mip-mapping for this map, you should use the Projected Texture Map node instead.

Projected Texture Map

The Projected Texture Map node is used to map a picture onto objects. It uses the coordinates of the current point to determine the color of the pixel in the texture map at that point. This node effectively combines the features of the Texture Map node (see above) and the UV Coordinates node. Please refer to these nodes for a description of the settings available in the Projected Texture Map node. One additional setting is specific to the Projected Texture Map node: the “Allow mip-mapping” option.

Allow mip-mapping: mip-mapping is a process whereby the software automatically generates lower resolution versions of the image and uses them instead of the full-blown image as soon as it is seen from a distance. While the results produced using mip-mapping are generally smoother, certain images may actually look better without mip-mapping. This option is here so that you can forbid mip-mapping for a specific image, should you need to (just uncheck the option).

…Studio, Producer…

Note:

you can control the level of mip-mapping for the entire scene using the “Texture filtering” option in the Anti-Aliasing Options dialog (Production version only).

Images mapped using the Projected Texture Map node will be mip-mapped according to global scene settings and the “Allow mip-mapping” option. **Mapping position mode**: options for this setting are: Automatic, World – Standard, World – Parametric, Object – Standard and Object – Parametric.

For **Projected Texture Maps**, a Texture Placement Editor is available for manipulation of the texture directly on the object.

Animation Map

The Animation Map node is used to map an animated texture onto objects. Its input is a texture coordinate and a time, and the animation map node returns the color of the pixel in the current frame of the animated texture map that is at the point indicated by the texture coordinate.

When you create an Animation Map node, SmartGraph automatically creates a “UV Coordinates” node and connects it to the node’s input. You can use the “UV Coordinates” node to define how the animation is mapped onto the object (see below for details on the “UV Coordinates” node).

Texture map nodes can be made to output any of the following values:

- **Color output:** the color of the pixel in the texture map that is at the point indicated by the texture coordinate.
- **Grayscale output:** the color of the pixel converted to a grayscale value.
- **Alpha output:** the alpha value corresponding to that pixel (if the point is inside the image, or 0 if it is outside the image).

When you connect a node to the output, a popup menu will appear so that you can select the desired type of output.

- **Image sequence:** this is the list of pictures to use in the animation. You can add new pictures by clicking the **Load** icon (). You can replace pictures in the list

...Studio, Producer...

by selecting them and then pressing Load. To remove images from the list, select them and then press the **Remove** icon ().

- **Frame rate:** this defines the playback rate of the pictures on the list. Ideally, this should at least be equal to the global animation frame rate.
- **Interpolate frames:** when this option is selected, in-between frames are interpolated by gradually blending the previous and the next frames. This ensures smooth playback and will avoid any jumps in the animated texture.
- **Animation filter:** use this filter to change the flow of time in the animated texture. Double-click on the filter to load a filter, or select **Edit** from the filter's popup menu to edit the filter.
- **Phase:** use this to adjust the start frame in the animation sequence. The value has to be set in seconds.

Image offset, **Interpolation type** and **Mirror X** & **Y** are identical to the settings in the **Color** tab of the Advanced Material Editor. Warning: if several frames of the animation are required to render the texture correctly at a given time (e.g. after connecting the phase to a noise), memory requirements may increase and rendering may slow down significantly.

The Animation Map node doesn't support mip-mapping. If you would like your animation map to be mip-mapped, please use the Projected Animation Map node below instead.

Projected Animation Map Node

The Projected Animation Map node is used to map an animation onto objects. It uses the coordinates of the current point and the time input to determine the color of the corresponding pixel in the appropriate frame of the texture map. This node effectively combines the features of the Animation Map node (see above) and the UV Coordinates node. Please refer to these nodes for a description of the settings available in the Projected Animation Map node. One additional setting is specific to the Projected Animation Map node: the "Allow mip-mapping" option.

Allow mip-mapping: mip-mapping is a process whereby the software automatically generates lower resolution versions of the image and uses them instead of the full-blown image as soon as it is seen from a distance. While the results produced using mip-mapping are generally smoother, certain images may actually look better without mip-mapping. This option is here so that you can forbid mip-mapping for a specific image, should you need to (just uncheck the option).

Note:

you can control the level of mip-mapping for the entire scene using the "Texture filtering" option in the Anti-Aliasing Options dialog.

...Studio, Producer...

Images mapped using the Projected Animation Map node will be mip-mapped according to global scene settings and the "Allow mip-mapping" option.

Mapping position mode: this setting is available for this node as well as the **Projected Texture Map** node. Options for this setting are: Automatic, World – Standard, World – Parametric, Object – Standard and Object – Parametric.

Blended Image Node

This node is similar to the Texture Map Node, except that it blends the image into an existing color input, using a smooth blending strip. Outside the image, the input color remains unaffected. Inside the image, the input color is replaced by the image. If the image defines an alpha channel, this value will be used in the blending ratio.

This node outputs the following values:

- **Color output:** the color of the pixel in the texture map that is at the point indicated by the texture coordinate.
- **Grayscale output:** the color of the pixel converted to a grayscale value.
- **Alpha output:** the alpha value corresponding to that pixel (if the point is inside the image, or 0 if it is outside the image).
- **Blend ratio:** the proportion of the input color that was replaced by the image according to the blend profile and position in the image (not taking into account the image's alpha value).

The settings available for this node are the following:

Image offset **and** Interpolation type **are identical to the settings in the Texture Map node.**

- **Smooth blending strip:** lets you define how gradual the blending is. A value of 0 means that the image replaces the input color as soon as the point is inside the image. A value of 100% means that the image fully replaces the input color solely at the exact center of the image.
- **Blend profile:** this setting controls how the blending is done. Possible values are:
  - **Square:** the blend ratio is defined according to the distance to the nearest edge of the image.
  - **Round:** the blend ratio is defined according to the distance from the center

of the image.

…Studio, Producer…

Blended Grayscale Image Node

This node is identical to the “Blended Image” node, with the difference that it acts on a number instead of a color (the input value is a number instead of a color). This number is replaced by the grayscale value of the image at the current point, according to the same rules as with the “Blended Image” node. This is particularly useful when designing procedural terrain functions, and you want to add real-world data at some point: simply use a “Blended Grayscale Image” node to replace the procedural altitudes with a DEM file at the desired location. Thanks to the smooth blending strip, the procedural altitudes will automatically blend into the DEM altitudes.

On top of the “Blended Image” node parameters, this node defines the following additional parameters:

- **Gain:** this is a gain factor that is applied to the grayscale values in the image (in order to adapt to the range of input values the range of values defined by the image).
- **Offset:** this is an offset that is applied to the grayscale values in the image.

Unlike the “Blended Image” node, this node does not define a “Color” output.

Image Sample and Multi-Image Sample Nodes

These texture map nodes are used with the Image Combiner node to create different texture effects. These need to be processed through the Image Combiner node or the transparency information won’t be processed correctly.

Each image sample node has the following settings, reflecting similar settings in the Material Editor. The image and pathname are displayed and various types of **UV Coordinates** can be selected:

- **Automatic:**
- **Flat (vertical):**
- **Faces:**
- **Cylindrical:**
- **Spherical:**
- **Torical:**
- **Conical:**

…Studio, Producer

- **Automatic UV:**

You can position the picture precisely on the object by using the **Image offset** commands. This will move the picture around by increments of one pixel.

When the material is seen from very close, you may see pixels, due to the limited resolution of the picture. To reduce this effect, choose an **Interpolation type** method:

- **None:** No over sampling.
- **Bi-linear:** Bi-linear interpolation between pixels.
- **Normalized:** Values proportional to the distance to the corners of the pixel.
- **Bi-cubic:** Bi-cubic interpolation between pixels (continuous derivative).
- **Density:** controls how many times the image is repeated.

In the **Rotation** section, you can select to rotate image samples in range and set the range using the slider.

You can also opt to **Flip** the image horizontally and/or vertically.

In the **Scale** section, you can indicate the **Global Sample Scale** of the picture along the X and Y axes with options to scale certain ranges on the X, Y axes. There is also an option to **Keep proportions** with scaling.

Use the **Image Sample** node to create even more special effects with image-based textures.

UV Coordinates Node

Studio, Producer

This node converts the current position into a texture coordinate. It is automatically created when you create a texture or animation map node.

- **Scale:** defines the overall size of the texture map along its two axes.
- **Origin:** defines the point of origin of the projection – e.g., when mapping in spherical coordinates, defines the center of the sphere.
- **Mapping mode:** this setting defines the method used by the node to convert 3D coordinates into the 2D texture map coordinates. There are several mapping modes available, each of them better suited for some types of objects. If you don't know which to use, select **Automatic**. For details on the different mapping modes, please refer to the Material Editor section about material colors being mapped from a picture.

Turbulence Nodes

Studio, Producer

Turbulence nodes are very similar to fractal nodes, with the main difference being that turbulence nodes work in 3 dimensions to create vector displacements, whereas fractal nodes only work in one dimension.

Although turbulence nodes should be applied to the **Origin** of noises or fractals in order to produce the expected results, you can achieve interesting results by using turbulence on other parameters.

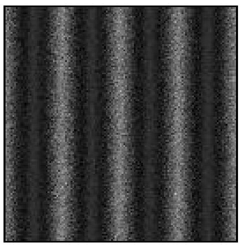
Turbulence will add interesting details to your functions, but this is at the expense of long processing times: in order to generate the turbulence, several iterations of the noise have to be computed along the 3 different axes, resulting in the long computation times.

Simple Turbulence

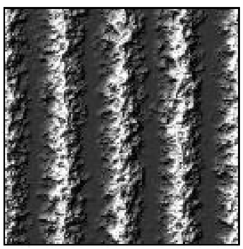
Studio, Producer...

The simple turbulence node uses a Perlin style noise to generate a 3D perturbation. The following settings are available:

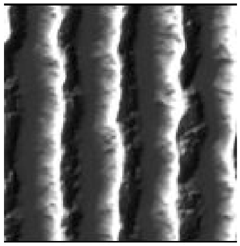
Wavelength, **Origin**, and **Largest feature**: these settings are the same as with the standard fractal nodes. Please turn to pages 449 through 455 for details on the fractal nodes.

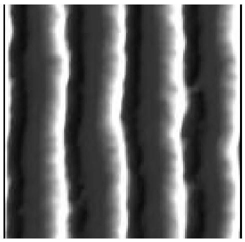


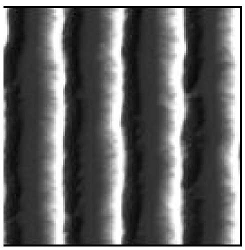
Largest feature 0.1



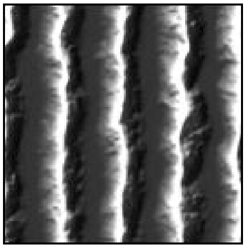
…Studio, Pro- ducer…



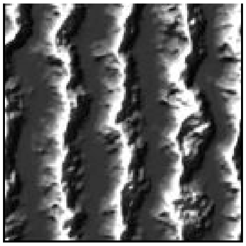




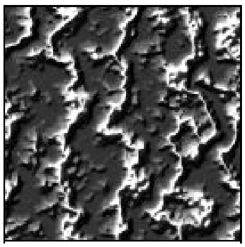
...Studio, Producer...



Amplitude 1

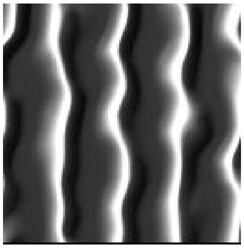


Amplitude 2



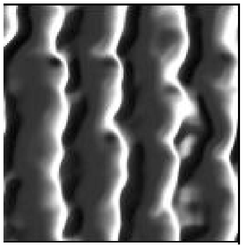
Amplitude 5

Repeat count: this parameter defines the number of iterations of the base noise that are computed to generate the turbulence. Higher repeat counts will create more detailed turbulence, only at the expense of longer render times.

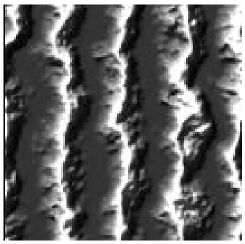


...Studio, Producer...

Repeat count 1

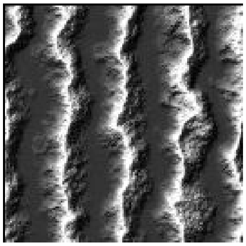


Repeat count 2



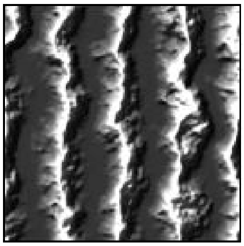
Repeat count 4

...Studio, Producer...

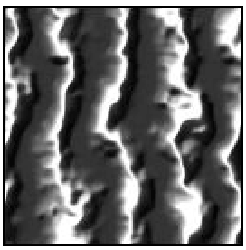


Repeat count 10

Scaling: this setting controls the frequency at which the noise varies relative to the current position.

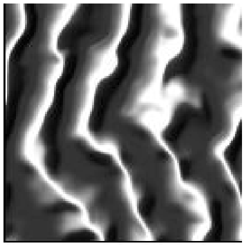


Scaling 0.5

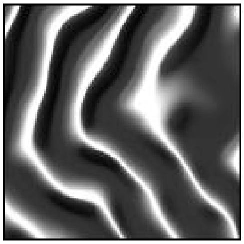


Scaling 1

...Studio, Pro- ducer...

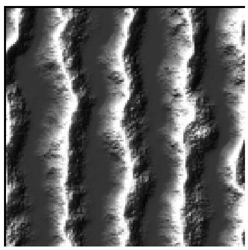


Scaling 2



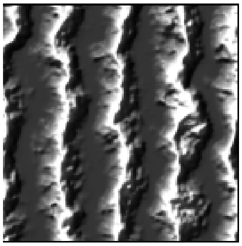
Scaling 5

Harmonics: this setting controls the way the noise is scaled each time an new iteration is added in: for each new addition, scale and amplitude are multiplied by the Harmonics parameter. If the "Repeat count" is equal to 1, this parameter has no influence. You should avoid values close to 1 as they tend to reduce the influence of additional iterations.

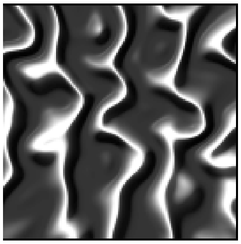


Harmonics 0.25

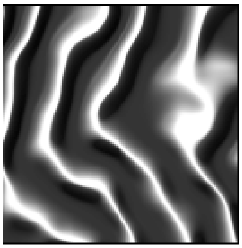
...Studio, Producer...



Harmonics 0.5

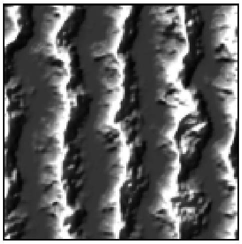


Harmonics 0.9



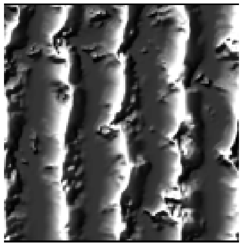
Harmonics 2

Combination mode: this drop-down list box lets you select how the successive noise iterations will be combined. For full details on combination modes, refer to the Basic Repeater fractal node.

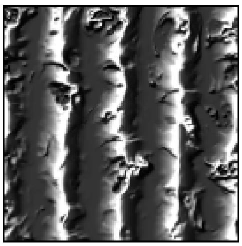


…Studio, Producer…

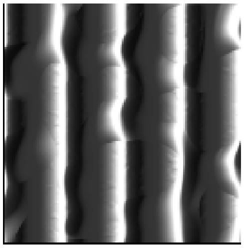
Combination mode = Add/Blend



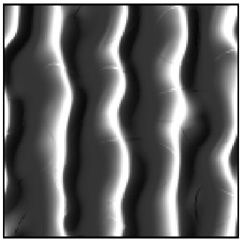
Combination mode = Variable roughness



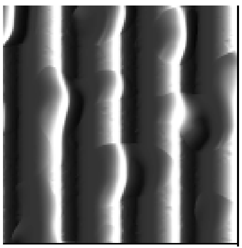
Combination mode = Variable roughness (abs)



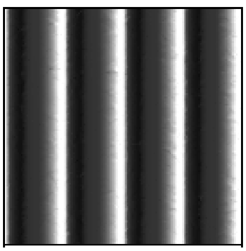
Combination mode = Max



Combination mode = Max (abs)

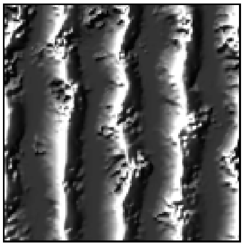


Combination mode = Min



...Studio, Producer...

...Studio, Producer

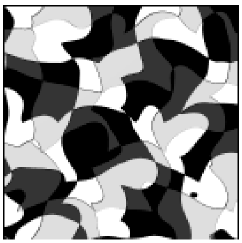


Misc Style Turbulence

Studio, Producer...

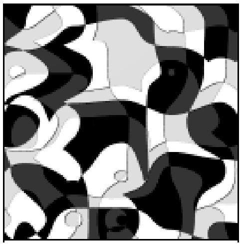
This turbulence node provides you with more control over the look of the turbulence but usually doesn't produce such nice results.

On top of the settings already defined by the Simple Turbulence node, this node lets you select the base **Noise** used to compute the turbulence.

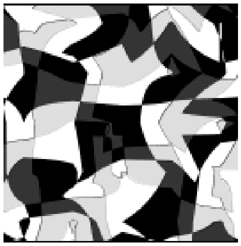


Perlin Gradient (default)

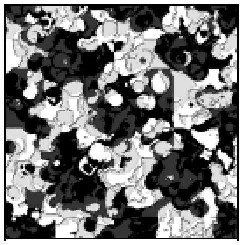
…Studio, Producer…



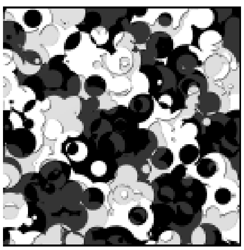
Perlin – Value



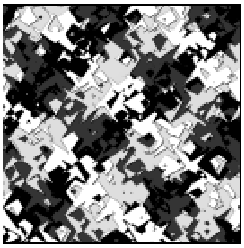
Perlin – Linear

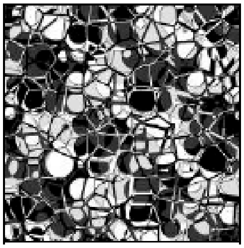


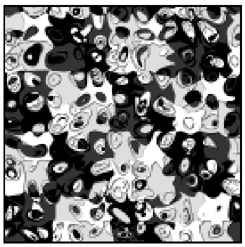
Distributed – Round Samples



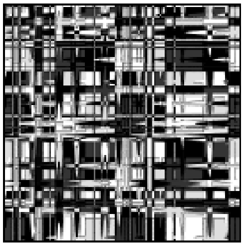
…Studio, Producer…



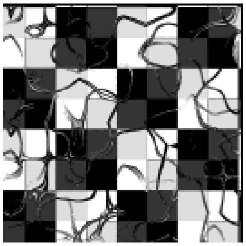




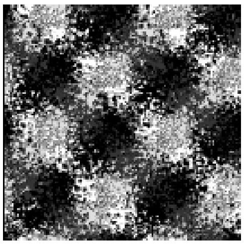
...Studio, Producer...



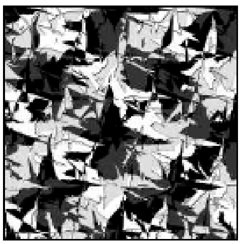
Line Patterns – Lines



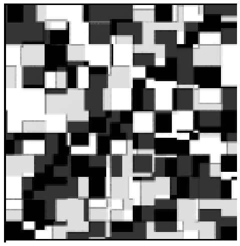
Line Patterns – Sparse Cracks

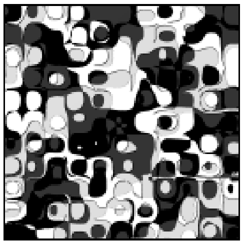


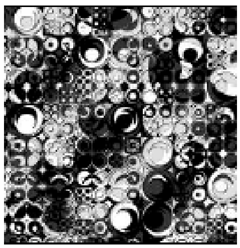
Other – Granite

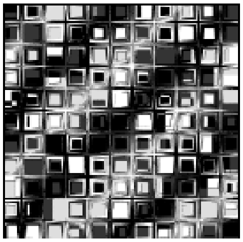


…Studio, Pro- ducer…









...Studio, Producer

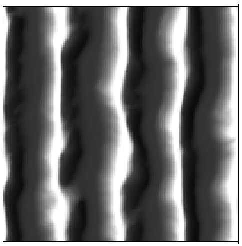
Squares – Stones Square

Advanced Turbulence

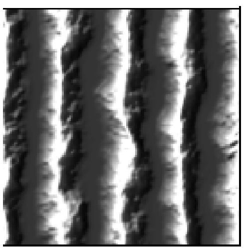
Studio, Producer...

On top of the settings already defined by the other turbulence nodes, this node defines the following:

Roughness: this is similar to the standard fractal "Roughness" parameter.

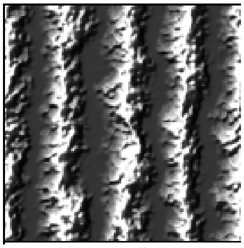


Roughness = 0.25

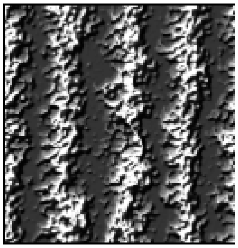


Roughness = 0.5

…Studio, Producer…

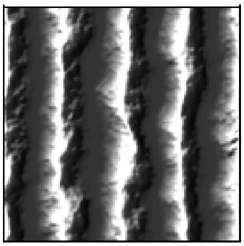


Roughness = 0.75

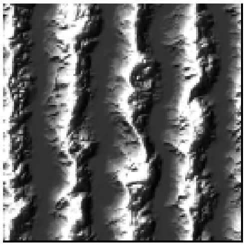


Roughness = 1

With vortices: check this option if you want the turbulence to exhibit vortices.

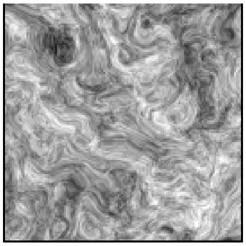


Without Vortices

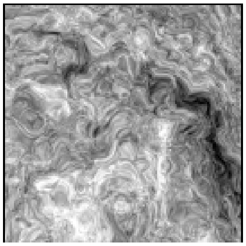


…Studio, Producer

With Vortices



Without Vortices



With Vortices

Metanodes

Studio, Producer

Studio, Producer…

Overview

...Studio, Producer

MetaNodes are a special type of node that encapsulates a graph, or part of a graph. You could think of them as the ability to group several nodes of a graph, but the concept behind MetaNodes is in reality a lot more powerful. Because MetaNodes can be saved and retrieved for future use, and because they give you the ability to easily create a simple user interface around them, you should rather think of them as a building block for more complex graphs.

Creating a MetaNode

Studio, Producer

To create a new MetaNode, simply select several nodes in a graph and click the **Group** icon of the Node options toolbar. The selected items are replaced by the metanode, and all connections to the items you selected are automatically re-connected to the MetaNode.

To remove the MetaNode and re-expose its content in the graph, simply click the **Ungroup** icon. The nodes that had been moved into the MetaNode will re-appear in the graph.

Editing a MetaNode

Studio, Producer

You can edit the content of a MetaNode by clicking the **Edit** button in the MetaNode properties.

When you edit the content of the MetaNode, a new instance of the Graph appears, displaying the MetaNode graph. You can edit this graph in the usual way.

Building a MetaNode Interface

Studio, Producer...

The Publish feature is used to make the corresponding parameter directly accessible from the top-level MetaNode details panel (at the bottom of the Function Editor, when you select the MetaNode in the graph where the MetaNode is located).

If you click the **Publish** icon, a little dialog will popup, prompting you to enter the name under which you wish to see the parameter appear in the MetaNode options. Enter a name and click **OK**. Now, if you close the MetaNode graph and select the MetaNode in the main graph, you will see that your parameter appears with the name you provided.

Using this ability, you can very easily create a simple interface to your MetaNode, by exposing only those parameters that are really useful for controlling the functionality of the MetaNode.

Note that MetaNode parameters are listed on the MetaNode options panel in the order in which they were published. There is no way to subsequently change this order.

…Studio, Producer

Saving and Re-using MetaNodes

Studio, Producer

You can save a MetaNode for future use by clicking the **Save** button in the MetaNode details panel.

When you save the MetaNode, a Standard File Browser will appear, letting you select the file under which to save the MetaNode. By default, the Browser opens on the MetaNodes folder, where you will see a set of sub-folders corresponding to the different types of nodes. If, for instance, you save your MetaNode in the Filters sub-folder, the MetaNode will subsequently appear in the Filter node menu, for easy access.

Using this feature, you can rapidly create and enrich your collection of ready-to-use MetaNodes, and thus rapidly create extremely elaborate function graphs.

Of course, you can also save MetaNodes into your own folder, and retrieve them using the Load button on the MetaNode details panel, or in the MetaNode graph editor.

Locking MetaNode Content

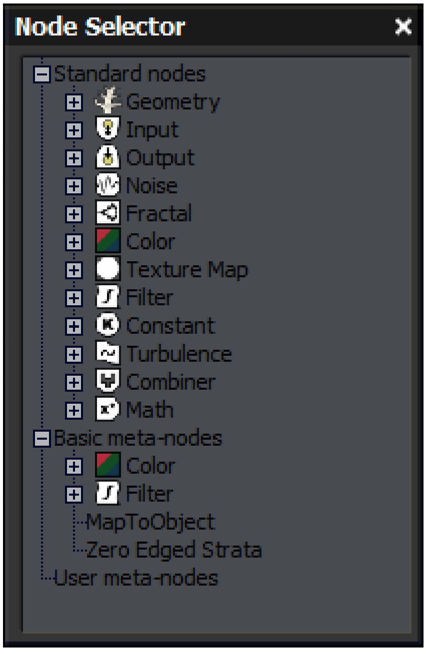
Studio, Producer

You can prevent other users from viewing or editing the content of your MetaNodes by pressing the **Lock** button on the MetaNode details panel. Beware, however, that once a MetaNode has been locked it is impossible to unlock it.

Node Selector

Studio, Producer...

The Node Selector displays the list of all available nodes.



Node Selector Dialog

Double-click to add the node to the graph and to display the node parameters for editing in the Parameters area.

- **Geometry:** see Vegetation nodes
- **Input:** see Input nodes
- **Output:** see vegetation output nodes
- **Noise:** a noise node outputs a number between -1 and 1. If a fractal node is selected, it will be converted to a noise node of the same base noise as the fractal
- **Fractal:** a fractal node is based on a noise that is repeated at several different frequencies in order to create much more elaborate patterns as the standard noise node. Fractal nodes create patterns that exhibit details over a large range of frequencies. If a noise node is selected at the time of clicking this icon, it will be replaced by a Simple Fractal node based on the same noise as the noise node

…Studio, Producer

- **Color:** depending on the context, color nodes either output a color based on the value of a number, or converts a color into another color. If a node is selected at the time of clicking this icon, again depending on context, a color node of the appropriate type will usually be added behind the selected node
- **Texture Map:** texture map nodes are used to map pictures (texture maps) onto objects. The texture map node is also created together with a Projection input node. The projection input node converts the current position into mapping coordinates used by the texture map node to map the texture
- **Filter:** filter nodes take a signal as input and output another signal. Clicking repeatedly on the Filter node icon will add as many filter nodes
- **Constant:** if another node was selected at the time of clicking, the selected node will be replaced by a constant node of the appropriate type
- **Turbulence:** turbulence nodes take a vector as input, and return a vector. They are usually plugged into the Origin noise parameter, as this is where they will behave as actual turbulence
- **Combiner:** combiner nodes are used to combine together different values. Most of them work on all types of data, and output the same type of data as the one provided in input
- **Math:** math nodes are used to perform all sorts of operations and conversions between different data types
- **Basic meta-nodes:** meta-nodes are made up of a combination of nodes that were combined for a desired effect. These can be saved and reused in plant creation
- **User meta-nodes:** saved meta-nodes

Node Observer

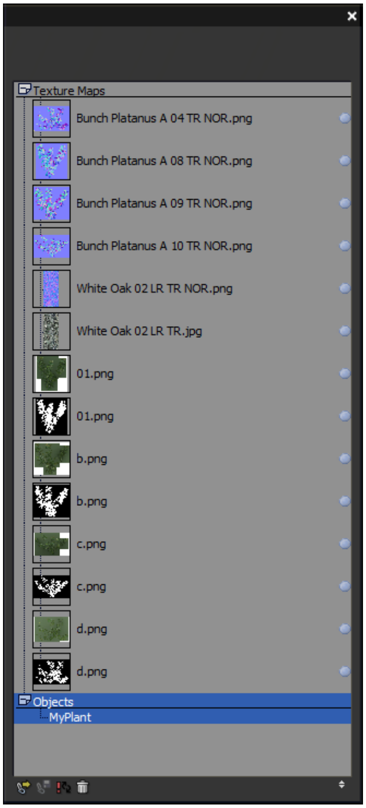
Node Observer

This panel is accessed by pressing the **Node Observer** in the Windows menu. This panel can be resized by its edges. By resizing the panel, you can enlarge the preview area.

The **Node Observer** is a simple panel that displays a view of the function's output. The nature of the view depends on the function's context.

Scale: use this setting to zoom in or out of the preview. Press the + and **-** signs to respectively reduce/increase the scale of the preview.

Imported Elements



Imported Elements

The *Imported Elements* maintains a list of all the external items that were loaded into PlantFactory, and the way they are linked. The list is organized in two categories:

- **Texture maps:** this category displays all the texture maps (imported pictures) used in the scene together with a small icon indicating the way the texture map is linked. Please check the details on the *Material Editor* for an example of loading a texture map.
- **Objects:** this category holds a list of all the objects that were created in another 3D application and imported into PlantFactory (see here for details on importing objects from other applications).

The contents of each category can be folded up. Unfolded categories are depicted by a 

(on Mac) on the left of the browser. To fold up and hide the contents of the category, click on that picture. The category folds up, and the button changes to (on Mac). Although the items are no longer displayed in the list, they still exist, and unfolding the category will show them back. Empty categories are depicted by a . Clicking on this has no effect.

Texture Maps

The first category displays a list of all the texture maps used in the scene. Clicking on a texture map name will select all the materials that use this texture map, and all the objects that use these materials. This is a handy way of checking which objects use a given texture map. Missing textures will be identified as broken links.

Double-click a texture to view the texture map at full resolution (using external viewer).

Alongside the name and preview of the texture map, you will notice a small symbol that identifies the way the texture map is linked. Possible linking options are:

- **No symbol:** with this linking option, only the name of the file is saved in the scene. When you reload the scene, the texture map will have to be at the same location in order to be successfully loaded. If you modify the texture map in an external application, the version used by Vue will not be updated until you reload the scene.
- **Synchronized:** this is similar to the previous option, except that the texture map is automatically reloaded if it has been modified in an external application (a prompt will appear offering to reload modified texture maps).
- **Incorporated:** with this option, the texture map is saved together with the scene. You don't have to worry about modifying or deleting the original file, because a copy of this file will be stored inside the scene. Of course, this results in much larger scene files, but is very useful when you need to transfer items to another party or publish them; you don't need to worry about including appropriate texture map files. If the texture map is modified in an external application, it won't be modified inside Vue until you reload it.
- **Incorporated and synchronized:** this is similar to the above option, except the texture map will be automatically reloaded if it is modified in an external application.

You can toggle the linking options of a texture map using the popup menu (see below).

Texture Map Preview

In front of each texture map filename is a tiny preview of the texture map used to facilitate identification. You can adjust the size of the preview using the **Preview size** ( ) control in the toolbar at the bottom of the *Imported Elements* (see below). Click on this control and drag the mouse up to increase the size of the preview. Drag down to reduce the size.

Imported Objects

Whenever you import an object created with another 3D application, this object will be listed in the *Objects* category of this list. Clicking on the name of an object in this list will select the corresponding object.

When you import an object from another 3D application, you have the possibility of decimating the object. Objects that have been decimated are identified by a small pictogram ( ) to the right of the object's name. You can remove decimation by re-importing the object without decimation (see below).

Popup Menu

The popup menu of the Imported Elements offers the commands below. Menu commands apply to the selected items or the item under the mouse cursor at the time of displaying the menu if no item is selected.

- **Incorporated:** select this menu option to toggle the incorporated status of the texture map under the mouse cursor. This option is only available if the item under the mouse cursor is a texture map.
- **Synchronized:** select this menu option to toggle the synchronized status of the texture map under the mouse cursor. This option is only available if the item under the mouse cursor is a texture map.
- **Locked:** This option locks the material image and the material to this object only. This operation cannot be undone.
- **Downsample:** this option allows you to non-destructively change the current resolution of the material. Your options are:
  - To halve resolution
  - To divide it by four
  - To divide it by eight
  - To select a custom downsampling coefficient

  This can be reversed by selecting the **Original size** option.
- **Replace Link:** selecting this menu command will display a standard Picture or

Object File Browser letting you select a picture or an object file that should replace the selected item.

- **Export Link:** selecting this menu command will display a Picture or Object File Browser letting you select the name of the file under which you would like to save an incorporated texture map or an imported object. This command is only available if the item under the mouse cursor is an incorporated texture map or an imported object (see here for details about exporting objects).
- **Reload Link:** select this menu command to reload a texture map or an imported object that has been modified in an external application. For Infinite and xStream users, if the reloaded item is an imported object, and this object has been decimated, it will be reloaded with the same level of decimation as previously imported.
- **Reload Without Decimation:** this menu command is only available if the item under the mouse cursor is an imported object, and this object has been decimated. When you select this command, the object will be re-imported without being decimated. Using this feature, you can import a large object, decimate it to facilitate placement and test rendering, and then re-import it without decimation when you are ready for the final rendering.
- **Reload All Without Decimation:** this command will reload the full geometry of all imported objects that have been decimated.
- **Incorporate All Texture Maps:** this command will simply incorporate all the texture maps that are not yet incorporated (see above for an explanation of incorporated texture maps). This is very handy if you want to make sure that all the texture maps are included with the scene before you transfer it to another party.
- **Copy all Texture Maps in a Folder:** this option copies all textures from the imported objects into a folder for future reference.

The Bottom Toolbar

At the bottom of the Imported Elements is a small toolbar. The effects of the buttons in this toolbar are:

- 

  Replace link: clicking this button will display a Standard File Browser letting you select a picture or an object that should replace the selected item.

- 

  Export link: clicking this button will display a standard Picture or Object File Browser letting you select the name of the file under which you would like to save an incorporated texture map or an imported object.

- 

  Reload link: click this button to reload a texture map or an imported object that has been modified in an external application. If the reloaded item is an imported object, and this object has been decimated, it will be reloaded with the same level of decimation.

- 

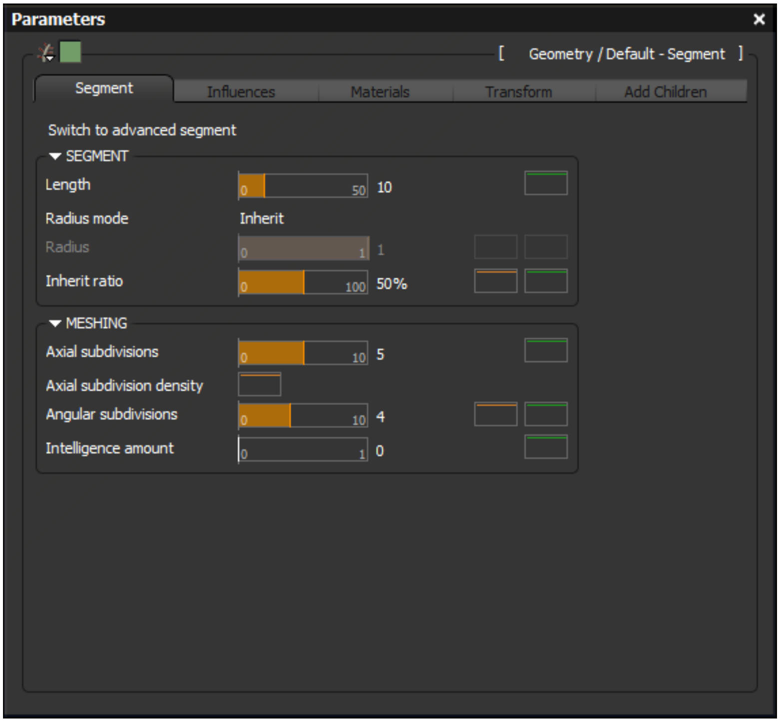
  Delete object: click this button to delete the selected object(s). This button is only available when the selected item is an imported object.

- 

  Preview size: this control is used to resize the texture map previews.

Section 5

Modifying Plants: Using Parameters



Parameters Window

Plants can be modifed by editing parameters of the graph nodes in the Node Parameters window. Parameters are arranged in tabs and groups. The tabs for each node may vary depending on the node selected, but most geometry nodes have some of the following basic tabs:

- **Geometry type:** The name on this tab mirrors the geometry selected on the graph. This tab further defines the plant's physical characteristics. Length, axis, radius are just a few of the plant's characteristics that can be modified on this tab. First setting on the geometry is a switch *Switch to simple segment/Switch to Advanced segment Segment.* This mode is very useful to create lots of small branches with less memory impact'
- **Materials:** You can select the materials for the different nodes of the plant – the leaves, trunk, branches.
- **Transform:** Here, global scale can be modified as well as offset, rotation angles, orientation tropism and mesh resolution. The fields available depend on the geometry selected.

The tabs for each geometry as well as the individual parameters will be presented in detail in the following section.

Multi Edition

Studio, Producer

The edition of multiple nodes at the same time allows the user to easily and quickly edit parameters from compatible nodes. Select the nodes to be modified and adjust any parameter. The parameters that are common between the selected nodes will be modified. Any type of parameter can be edited for multiple nodes at the same time (value, checkbox, filter, section...).

Geometry Plant Parameters

A set of parameters is available for every type of plant geometry you can use to create parts of a plant.

These are:

- Segment
- AutoGrowth
- Leaf
- Warpboard
- Object
- Urchin
- Hydra
- Ball

In this section, all of the parameters for each of these geometries will be presented.

Segment

The Segment node can either :

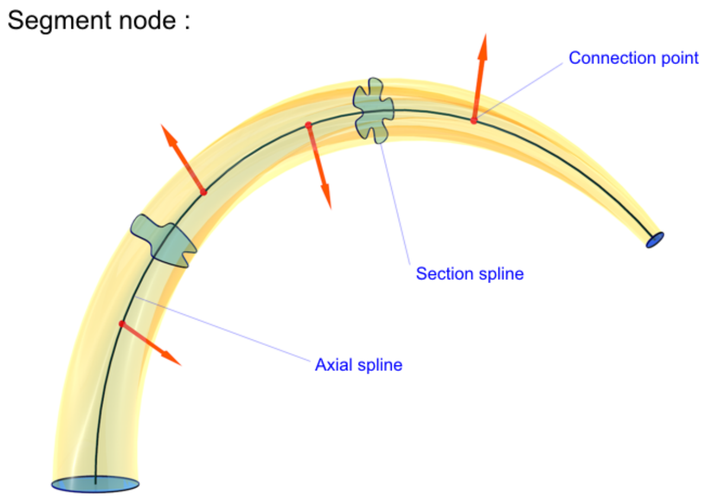
- generate geometry, a mesh surface
- act as a multiplier, manage connections with offspring growing from it

The basic geometry of the segment node is defined by a set of section and axial splines.

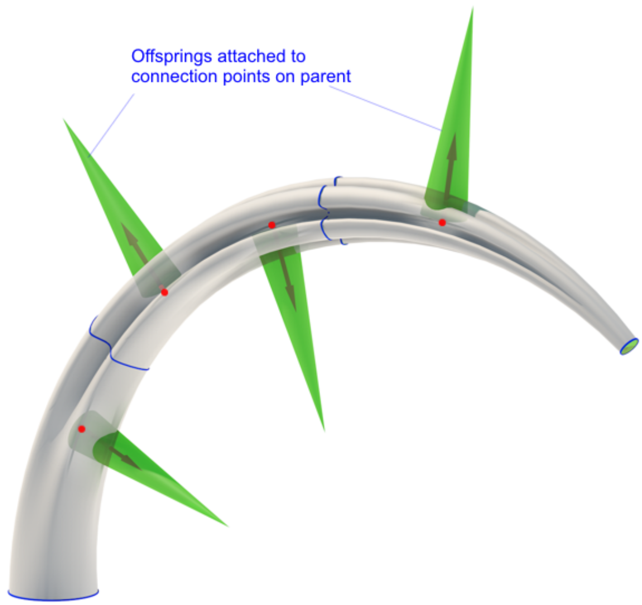
There are also other ways to enrich segment geometry :

- Blades: lateral surfaces mainly used as leaves or pines.
- Cap: defines the top cover of the segment.
- Root flares: modifies the lower part of the segment to simulate root flares on trunk.
- Blending with parent: adjusts segment surface so that it blends with the parent primitive instance.

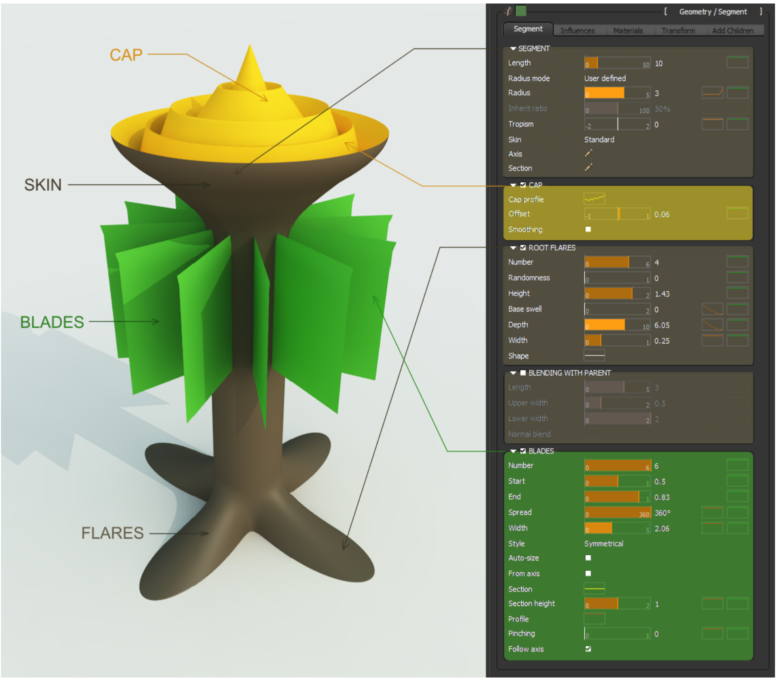
They are configurable on the Segment tab.



(a) **Segment node basics**



(b) **Parent & Offspring**



Segment components

The axial spline shape can be adjusted procedurally from the Segment Influences Tab using the Local Biases.

Segment Parameters

The **Segment** parameters are set on the following four tabs:

Segment Tab

Influences Tab

Materials Tab

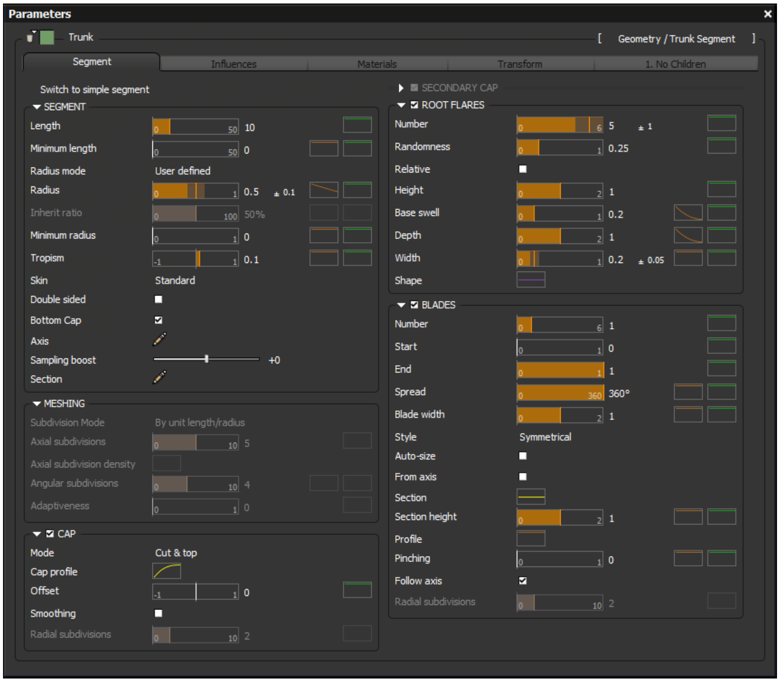
Transform Tab

There is also a tab used to add children to the current segment.

Add Children Tab

Segment Tab

The Segment tab is quite complex as it can be used to generate lots of different shapes. The basic segment shape is a cylinder, but you can apply a lot of deformations to make it look like a branch, a fruit or even a leaf if you flatten it enough. It can also receive blades to add radial elements.



Segment Tab

The first field is a switch **Switch to simple/advanced segment**. The simple segment disables some of the segment features to simplify the use of this node and optimize the final plant with unnecessary option.

Check the box near the title of each section of any tab to activate them.

Many of the fields on this tab are range parameters. The value can be changed by moving the slider to the left or right. When the field is selected you will also see a "±" symbol and a field. Here you can enter a value for variance of the slider value. For more information about using this field, please read the Random Range Parameter page.

Most of the fields on this tab have two filters available. One for the current instance and one for the parent instance. For more information about the use of these filters, check the Filter Editor page.

Segment

- **Length:** the length of the segment.
- **Minimum length:** the minimum length of the segment. The segment will never be smaller than this value,.
- **Radius mode:** there are three types of radius mode:
  - **Inherit:** radius is dependent on the radius of the parent. It is usually a fraction of the current radius. If **Inherit** is selected, then the **Radius** field specification is not available.
  - **User defined:** user defines the radius.
  - **Inherit, clamped to radius:** radius is dependent on parent radius, but ratio can still be defined. The current segment radius can be no larger than a fraction of the parent radius.
- **Radius:** not available if **Radius mode** is **Inherit**. Otherwise, specify the radius.
- **Inherit ratio:** not available if **Radius mode** is **User defined**. Otherwise, specifies the ratio of the radius to the parent.
- **Tropism:** specify the amount of tropism, a vertical external force.
- **Skin:** this defines whether the segment should have a physical geometry and whether it should stem from an imported mesh-like object or from functions.
  - **Standard:** the segment geometry and shape will be fully defined by functions.
  - **From object:** an imported object will be replicated in the plant. However some segment properties may still be used to control the segment axis.
  - **None:** the segment acts merely as a child primitive instance distribution node. The geometry itself is invisible.
- **Double sided:** creates double sided geometry for a segment (useful if no caps)
- **Axis:** select to open the **Axis Spline Editor** where you can modify the axis.
- **Sampling boost:**
- **Section:** select to open the **Section Spline Sets Editor** to create sections in the segment and modify the shape of each segment.

Meshing

These parameters are used for manual subdivision

- **Axial subdivisions:** defines the number of subdivisions along the segment.
- **Axial subdivision density:** defines the distribution of the axial subdivisions along the segment.
- **Angular subdivisions:** defines the number of subdivisions around the segment.
- **Intelligence amount:** defines if subdivisions distribution is done automatically or using density parameter.

Cap

These parameters are used usually for thick segments with significant size of cap, for example, disc flowers, mushrooms or cut branches.

- **Mode:** you may separate cut branches caps & top caps here. Doing so will enable "Secondary Cap" group that will handle the remaining case.
- **Cap profile:** defines the shape of the cap. The default value for a cap is flat (see Filter parameter).
- **Offset:** the cap's offset from the segment.
- **Smoothing:** activates normal blending to create a continuous transaction between segment and cap.
- **Radial subdivisions:** defines the number of subdivisions along the cap (only with manual subdivision).

Root Flares

Root flares are the visible root system above ground.

- **Number:** the number of visible root flares.
- **Randomness:** how randomly spaced these flares are around the segment.
- **Height:** how high up the segment the root flares will reach from the ground.
- **Base swell:** how thick the root flares are.
- **Depth:** this defines how far out from the base the flares will extend.
- **Width:** defines the width or thickness of the flares.
- **Shape:** defines the shape of the flares (see Filter parameter).

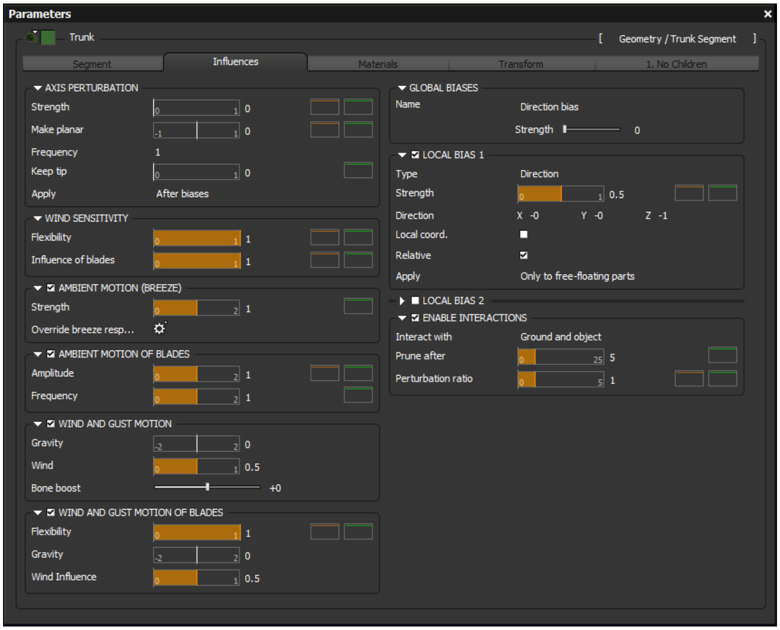
Blades

This section defines a blade when used to create leaves, petals or conifer stamps with pines.

- **Number:** the number of blades per segment.
- **Start:** where the blade starts on the segment, the lower limit.
- **End:** where the blade ends on the segment, the upper limit towards the tip.
- **Spread:** the spreading angle of the blade instances around the segment.
- **Width:** the width of the blade.
- **Style:** there are three styles of blades:
  - **Single:** appears on one side of the segment only.
  - **Symmetrical:** appears on both sides of the segment equally, two mirrored symmetric glades.
  - **Full width:** two blades sharing the same profile function.
  - **Simple flat:** one flat blade equally on either sides of the segment, optimized for simple cases.
- **Auto-size:** if enabled, the blade width and height depend on segment length.
- **From axis:** defines whether the blade innermost point should be located on the segment surface or on its axis.
- **Section:** defines the shape of the section (see Filter parameter).
- **Section height:** blade height with a multiply factor for the section function.
- **Profile:** blade shape. UVs are cut.
- **Pinching:** defines the profile behavior with a section. **0** profile cuts the section, **1** profile shrinks the section.
- **Follow axis:** if disabled, blade construction is based on branch main axis instead of real branch axis.
- **Radial subdivisions:** defines the number of radial subdivisions of the blade (only with manual subdivision).

Segment Influences Tab

This tab defines static and dynamic deformations which can be applyied on segment geometry .



Influences Tab

Many of the fields on this tab are range parameters. The value can be changed by moving the slider to the left or right. When the field is selected you will also see a "±" symbol and a field. Here you can enter a value for variance of the slider value. For more information about using this field, check the Random Range Parameter page.

Most of the fields on this tab have two filters available. One for the current instance and one for the parent instance. For more information about the use of these filters, check the Filter Editor page.

Axis Perturbation

These parameters can add a noisy deformation to the segment axis.

- **Strength:** the strength of the perturbances on the segment. The higher the value, the more pronounced the perturbances are.
- **Make planar:** this flattens the perturbation. It indicates whether the perturbation should be one-dimensional (factor near 0) or apply to the second dimension as well.
- **Frequency:** perturbation frequency along the local axes of the segment.
- **Keep tip:** forces segment tip to stay at its original position.

- **Apply:** defines whether the perturbation will be applied before or after biases.

Wind Sensitivity

- **Flexibility:** amplitude of segment flexibility under dynamic deformations.
- **Influence of blades:** influence of blades on segment dynamic deformations.

Ambient Motion (Breeze)

These parameters add basic breeze animation.

- **Strength:** strength of breeze animation on segment
- **Override breese settings:** this can override global breeze settings on segment (see Advanced Breeze Response Parameter)

Ambient Motion Of Blades

These parameters add wave deformation on blades

- **Amplitude:** amplitude of breeze animation on blade.
- **Frequency:** wavelength of breeze animation on blade.

Wind And Gust Motion

These parameters add advanced dynamic deformations.

- **Gravity:** strength of gravity influence on a segment.
- **Wind:** strength of wind influence on a segment.
- **Bone boost:** influences the number of bones created for rigged effects

Wind And Gust Motion Of Blades

These parameters add advanced dynamic deformations on blades.

- **Flexibility:** amplitude of blade flexibility under dynamic deformations.
- **Gravity:** strength of gravity influence on blades.
- **Wind:** strength of wind influence on blades.

Global Biases

- **Name:** type of bias. The only bias available is **Direction**.
- **Strength:** the strength of the directional bias.

Local Bias

- **Type:** types of local biases are:
  - **Direction:** makes the segment bend.
  - **Planar:** makes the segment grow as if trying to align itself with a plane.
  - **Attractor:** attracts the segment towards a point.
  - **Axis repeller:** makes the segment grow as far away as possible from an axis.
  - **Swirl:** makes the segment gently swirl.
  - **Curl:** influences segment growth as to create loops or loop fractions.
  - **Twist:** rotates the segment around its axis.
- **Strength:** strength of the local bias. Variance can be specified.
- **Direction:** direction associated to the local bias.
- **Local Coord.:** tells which coordinates system is used for direction definition.
- **Relative:** if checked, the force amount will be made dependent on the segment length.
- **Planar (Twist only):** if checked, twist will be applied to make segment as horizontal as possible.
- **Apply:** there are three application choices:
  - **Only to free floating parts:** the local bias is applied only to the segment parts that don't grow on the object.
  - **To entire segment:** the local bias is applied on the whole segment.
  - **Only to parts growing on object:** The local bias applies only to the parts growing on the object.

Enable Interactions

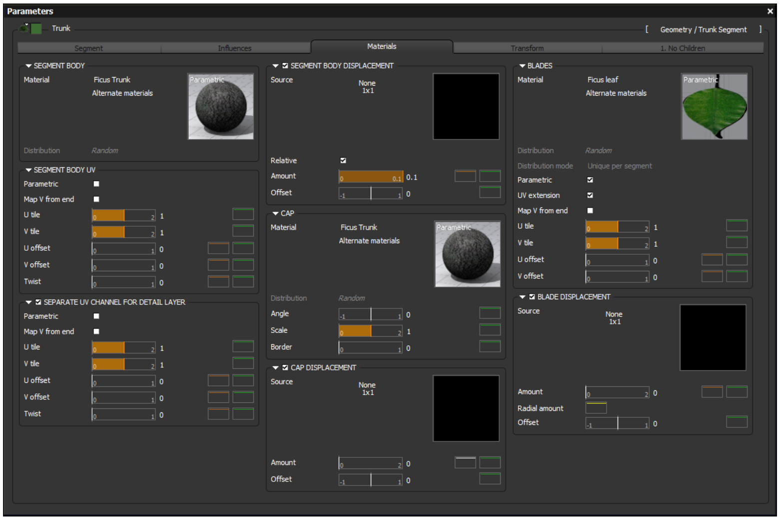
This section is used if the segment is interacting with a surrounding object or the ground.

- **Interact with:** this specifies the interaction mode.
  - **Ground:** only interact with the ground;
  - **Object:** only interact with an object;
  - **Ground and Object:** interact with both the ground and an object.
- **Prune after:** if non-zero, specifies the distance where the segment is cut if the object to grow on isn't found.
- **Perturbation ratio:** this setting can make axis perturbation stronger or weaker

on segment sections that grow on the object.

Segment Materials Tab

This tab defines materials and displacements for the segment body, caps and blades. For more information about material definition, also check the Material editor section.



Materials Tab

Most of the fields on this tab have two filters available. One for the current instance and one for the parent instance. For more information about the use of these filters, check the Filter editor page.

Segment Body

- **Material:** defines the material for the segment body (see Material parameter).
- **Distribution:** distribution of the materials of the segment body in case of multiple materials (see Distribution parameter).

Segment Body UV

- **Parametric:** check if mapping mode is Parametric. With Parametric mode, the texture mapping won't depend on the length of the segment.
- **Map V from end:** when this option is enabled, the texture mapping will be applied

starting from the end of the segment so that the texture is aligned to the end of the segment rather than to its root.

- **U tile:** scales the U texture coordinate of the segment body by a factor.
- **V tile:** scales the V texture coordinate of the segment body by a factor.
- **U offset:** offsets the U texture coordinate of the segment body by a factor.
- **V offset:** offsets the V texture coordinate of the segment body by a factor.
- **Twist:** rotates the UV coordinates continuously along the segment length.

Segment Body Detailing

- **Parametric:** check if mapping mode is Parametric. With Parametric mode, the texture mapping won't depend on the length of the segment.
- **U tile:** scales the U texture coordinate of the segment body by a factor.
- **V tile:** scales the V texture coordinate of the segment body by a factor.
- **U offset:** offsets the U texture coordinate of the segment body by a factor.
- **V offset:** offsets the V texture coordinate of the segment body by a factor.
- **Twist:** rotates the UV coordinates continuously along the segment length.

Segment Body Displacement

- **Source:** defines the displacement map or function for the segment body.
- **Load:** load a bitmap for displacement. The Bitmap Browser displays for selection of a bitmap. There are also controls for blur, gamma, and inversion of image.
- **Relative:** tells whether the displacement amount should be relative to the segment radius or not.
- **Amount:** set the amount of radial displacement on the segment body.
- **Offset:** applies a global offset to the segment body radius displacement.

Cap

- **Material:** defines the material for the cap (see Material parameter).
- **Distribution:** distribution of the materials of the segment upper cap in case of multiple materials (see Distribution parameter).
- **Angle:** UV rotation angle from cap center.

- **Scale:** UV scale from cap center.
- **Border:** the size of external ring that used branch body material instead of cap material.

Cap Displacement

- **Source:** defines the displacement map or function for the cap.
- **Load:** load a bitmap for displacement. The Bitmap Browser displays for your choice. There are also controls for blur, gamma, and inversion of image.
- **Amount:** set the amount of height displacement on the cap.
- **Offset:** applies a global offset to the cap height displacement.

Blades

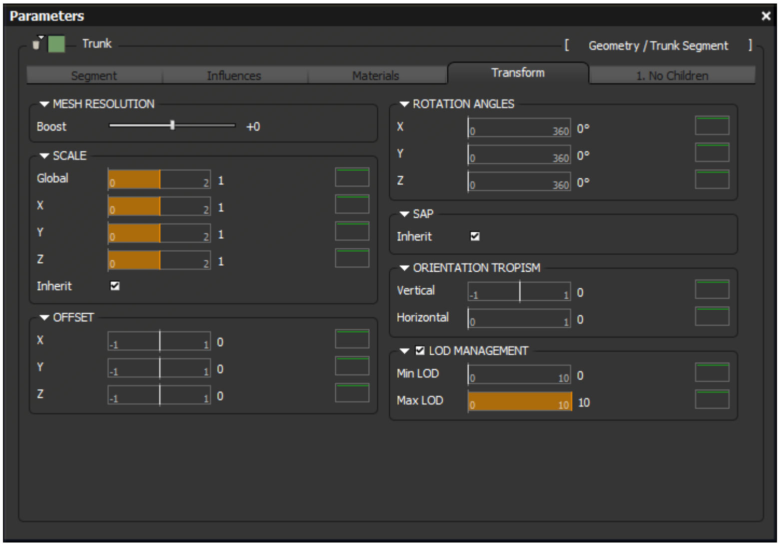
- **Material:** defines the material for the blade (see Material parameter).
- **Distribution:** distribution of the materials of the segment blades in case of multiple materials (see Distribution parameter).
- **Parametric:** check if mapping mode is Parametric. In Parametric mode, the texture mapping won't depend on the size of the blades.
- **UV extension:** in case of symmetrical blades, extends the UV coordinates on both blades.
- **U tile:** scales the U texture coordinate of the segment body by a factor.
- **V tile:** scales the V texture coordinate of the segment body by a factor.
- **U offset:** offsets the U texture coordinate of the segment body by a factor.
- **V offset:** offsets the V texture coordinate of the segment body by a factor.

Blade displacement

- **Load:** load a bitmap for displacement. The **Bitmap Browser** displays for selection. There are also controls for blur, gamma, and inversion of image.
- **Source:** defines the displacement map or function for the blade.
- **Amount:** set the amount of height displacement on the blade.
- **Radial amount:** applies a scaling function on the blade displacement to make it dependent on the distance from the segment axis (see Filter parameter).
- **Offset:** applies a global offset to the blade height displacement.

Segment Transform Tab

These parameters globally modify the segment position and orientation with respect to the rest of the plant.



Transform Tab

Many of the fields on this tab are range parameters. The value can be changed by moving the slider to the left or right. When the field is selected you will also see a "±" symbol and a field. Here you can enter a value for variance of the slider value. For more information about using this field, check the Random Range Parameter page.

Most of the fields on this tab have two filters available. One for the current instance and one for the parent instance. For more information about the use of these filters, check the Filter Editor page.

Mesh Resolution

- **Boost:** Set to increase the quality of mesh resolution (only with automatic resolution)

Scale

- **Global:** Globally scales the segment in all directions.

- **X, Y, Z:** Globally scales the segment in each of the directions of its local coordinates system.
- **Inherit:** Tells whether the segment scale is impacted by its parent or not.

Offset

- **X, Y, Z:** Globally offsets the segment by a translation along the different vectors.

Rotation Angles

- **X, Y, Z:** Globally rotates the segment around its local axis by an angle in degrees.

Sap

- **Inherit:** Sets whether the sap value of the parent primitive instance is inherited by this segment or not.

Orientation Tropism

- **Vertical:** Used to adjust the segment global orientation towards top or bottom.
- **Horizontal:** Used to adjust the segment global orientation towards the nearest horizontal direction.

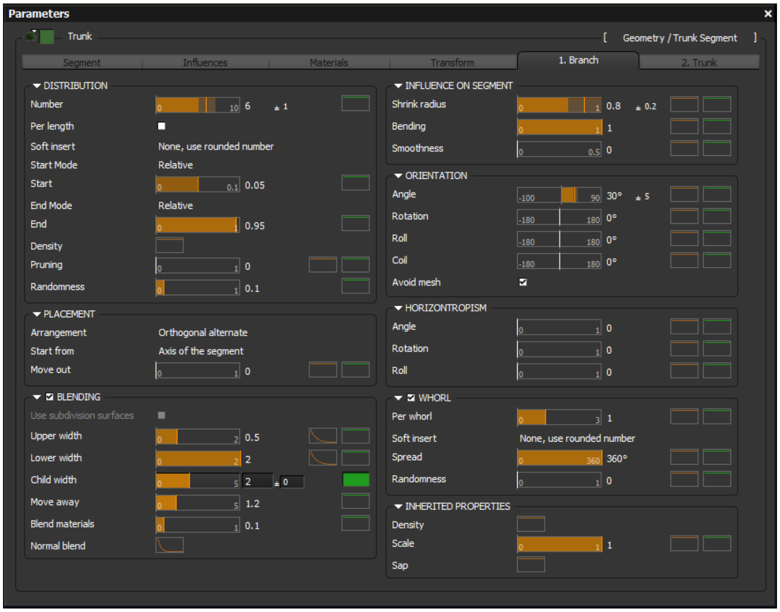
LOD Management

Studio, Producer

The segment is visible only when the current LOD is between the **Min LOD** and the **Max LOD**

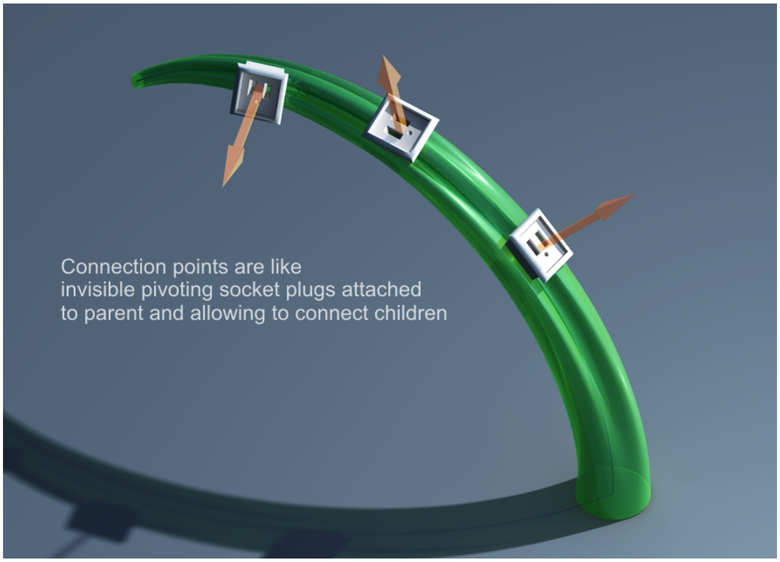
Segment Add Children Tab

These parameters impact how this segment's children should be generated with respect to their parent.



Children Tab

This is the last tab of the segment node. It can have various names. When a new node is connected to the segment, this tab receives the name of this node. The user can rename it by right clicking on the tab name. When a new node is created, it has no connections defined. The connection tab name is then **Add Children** and the tab is empty, featuring just one button. **Add Children** Clicking on the Add Children button the this tab opens a menu with geometry nodes as well as **Add influencing children**. Selecting one of these creates a new **Connections tab** with parameters defining connection points to which child instances are connected. In the connection tab you can define how many connection points should be on segment, how they should be arranged, in which directions they should point etc... You can imagine connection points as virtual (invisible) pivoting plugs to which child objects may be connected.



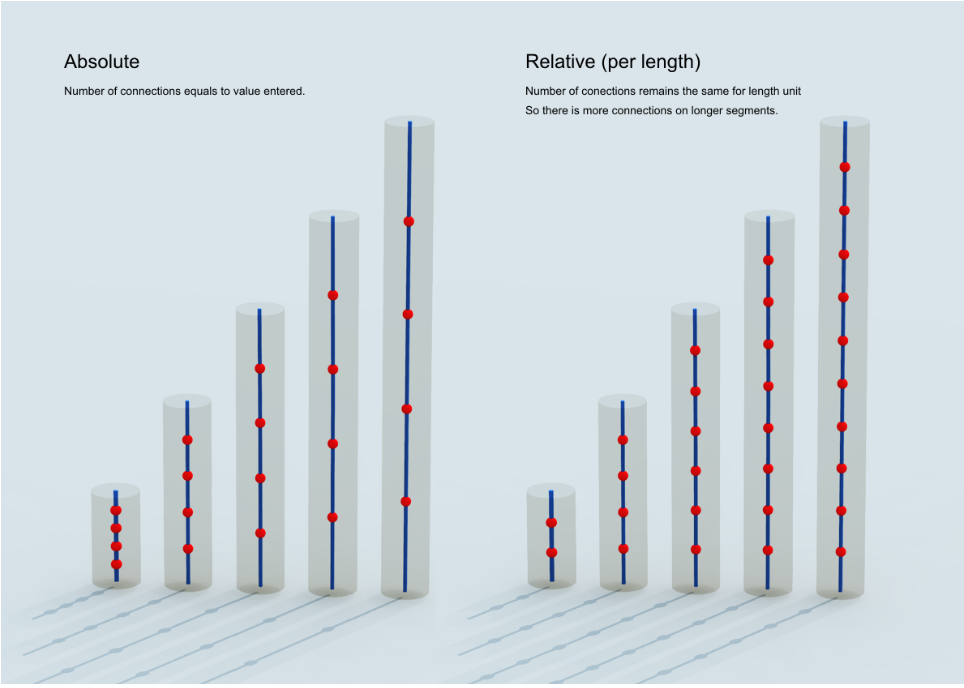
Connection points are like socket plugs

Those plugs have their position, direction, and they can also control how much sap is delivered to connected objects.

Distribution

Manages the number of connections, and how they are distributed over the segment length.

- **Number:** Defines the quantity of connections.
- **Per length:** The quantity of connections can be absolute, or relative to segment length if **Per length** is checked.



Number of connections : Absolute & Relative

(Notice that the final amount of connections can be also influenced by parameters in parent nodes like sap or density.)

- **Soft insert:** Controls the children distribution behavior in case the child instances number has a fractional part. To some point this can simulate the growth of child branches on parent branch.
  - **None, use rounded number:** the child instances number fractional part is removed.
  - **Offset fractional part:** an extra child instance is generated and it is placed according to the fractional part of the child instances number.
  - **Scale down fractional part:** an extra child instance is generated and its dimensions (length, radius, scale...) are scaled down according to the fractional part of the child instances number.
  - **Random:** an extra child instance is generated randomly according to the fractional part of the child instances number.
- **Start mode:** specifies how the value *Start* parameter (below) should be interpreted.
  - **Relative:** the value is a ratio between 0 (the root) and 1 (the end);
  - **Absolute from start:** the value is a raw distance, starting from the root of

the segment;

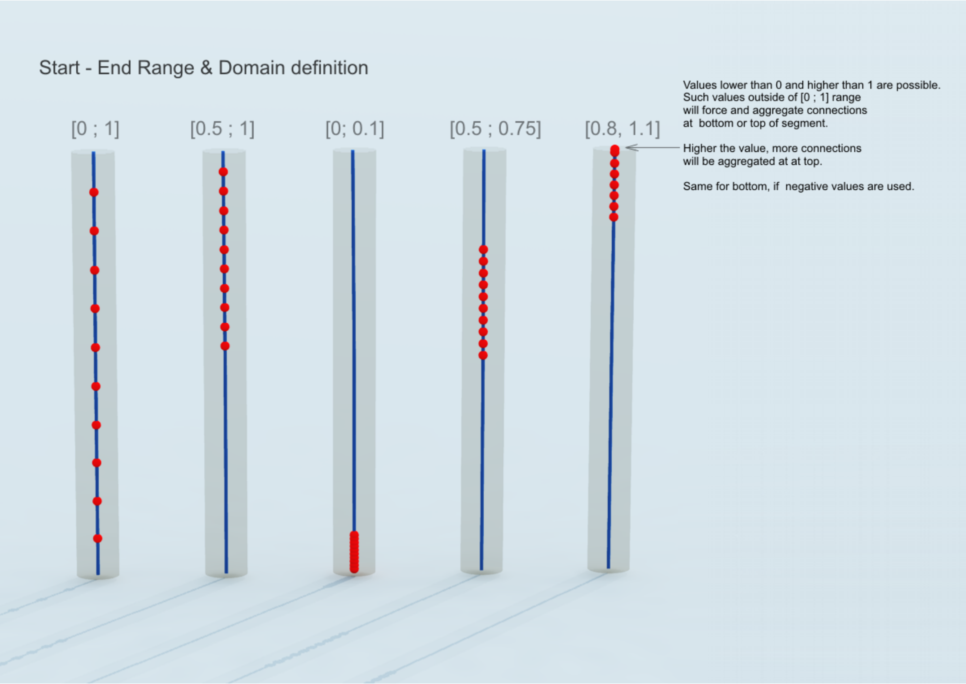
  - **Absolute from end:** the value is a raw distance, starting from the end of the segment.

- **Start:** Lower limit to where connections should be created.
- **End mode:** specifies how the value *End* parameter (below) should be interpreted.

  - **Relative:** the value is a ratio between 0 (the root) and 1 (the end);
  - **Absolute from start:** the value is a raw distance, starting from the root of the segment;
  - **Absolute from end:** the value is a raw distance, starting from the end of the segment.

- **End:** Upper limit to where the connections should be created.

  The **Start** – **End** parameters define the limits of the range where connections should be created, in segment axis coordinates. This is handy to create branches only on top part of tree trunk, and leave lower part without branches :



Start-End parameters

Here some examples:

Examples

Obviously you have to define **Start value** larger than **End value**.

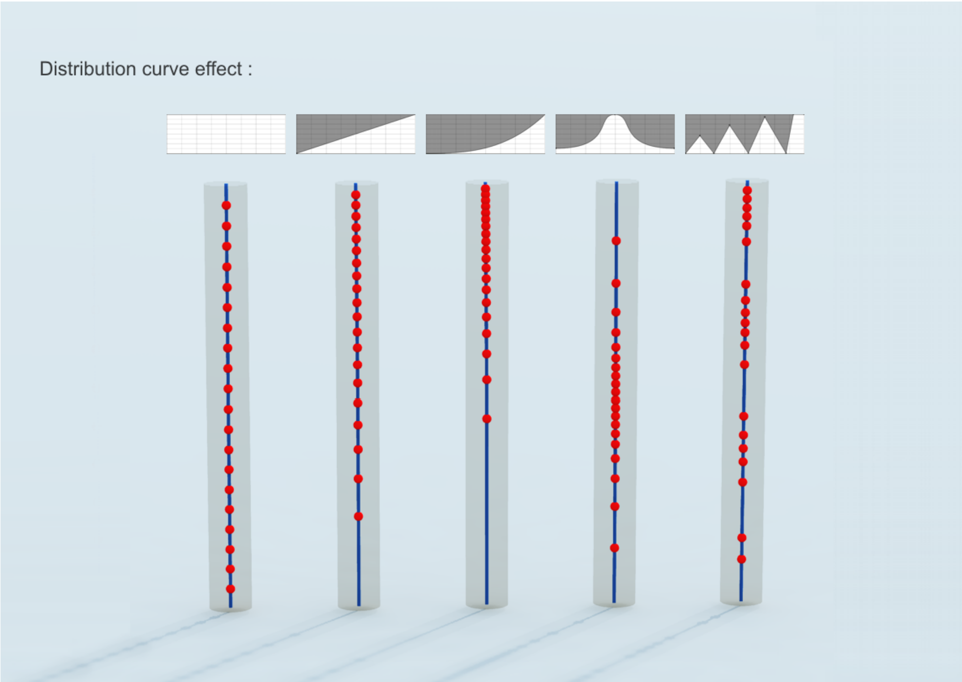
Values lower than 0 and higher than 1 are possible.

Such values outside of [0 ; 1] range will force and aggregate connections at bottom or top of segment. The higher the value, the more connections will aggregate at the top. Same for bottom, if negative values are used.

The **Start** – **End** parameters also define the **domain** for further parameters in connection tab. The domain of the x-axis of the first filter of the parameters with two filters corresponds to the start-end range.

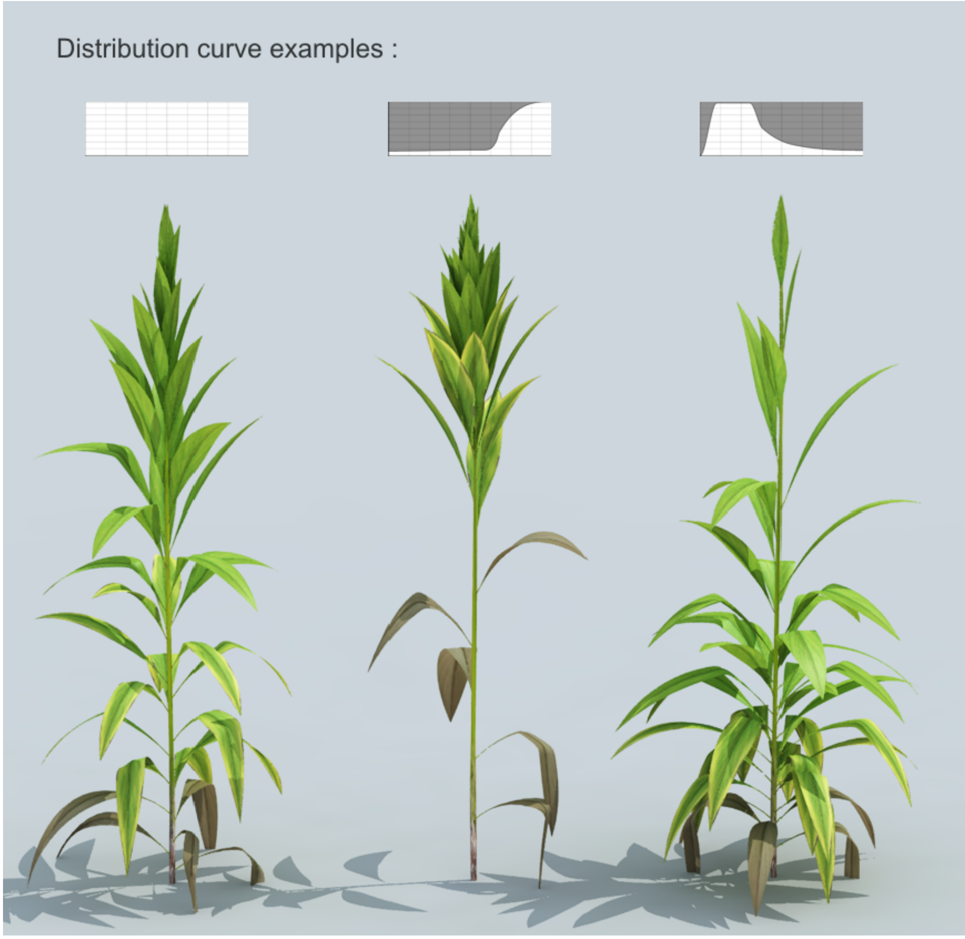
- **Density:** The density curve defines the connections distribution along the start-end domain.

  The higher the value defined on the curve graph, the more connections will aggregate in this area.



Distribution curve effect

Here some examples:

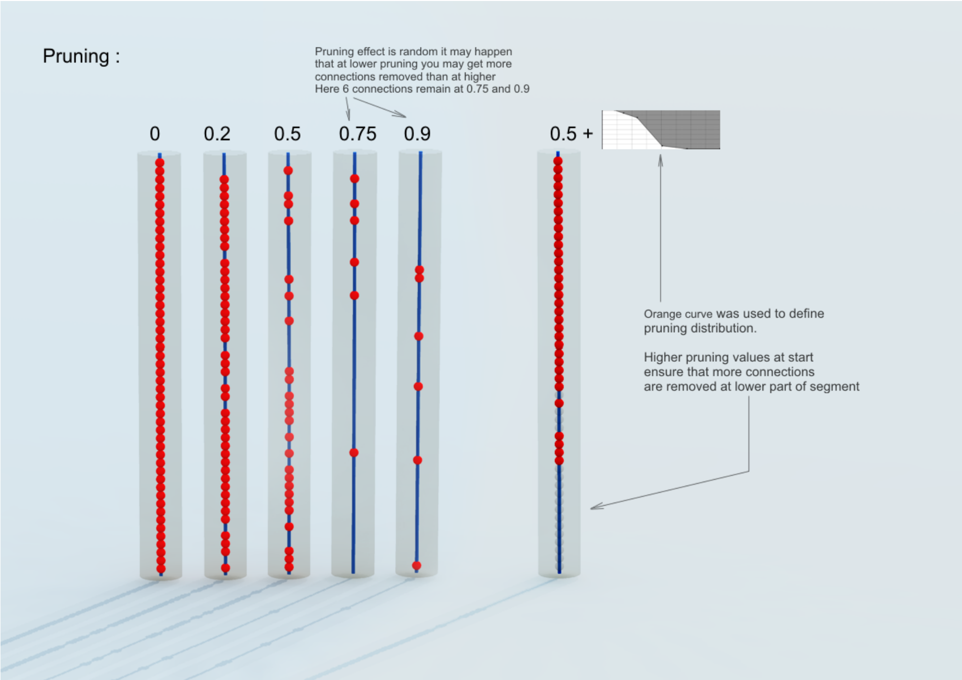


Examples

Example : With density curve you can define dense foliage at top and sparse at bottom.

- **Pruning:** Defines probability of connection removal.

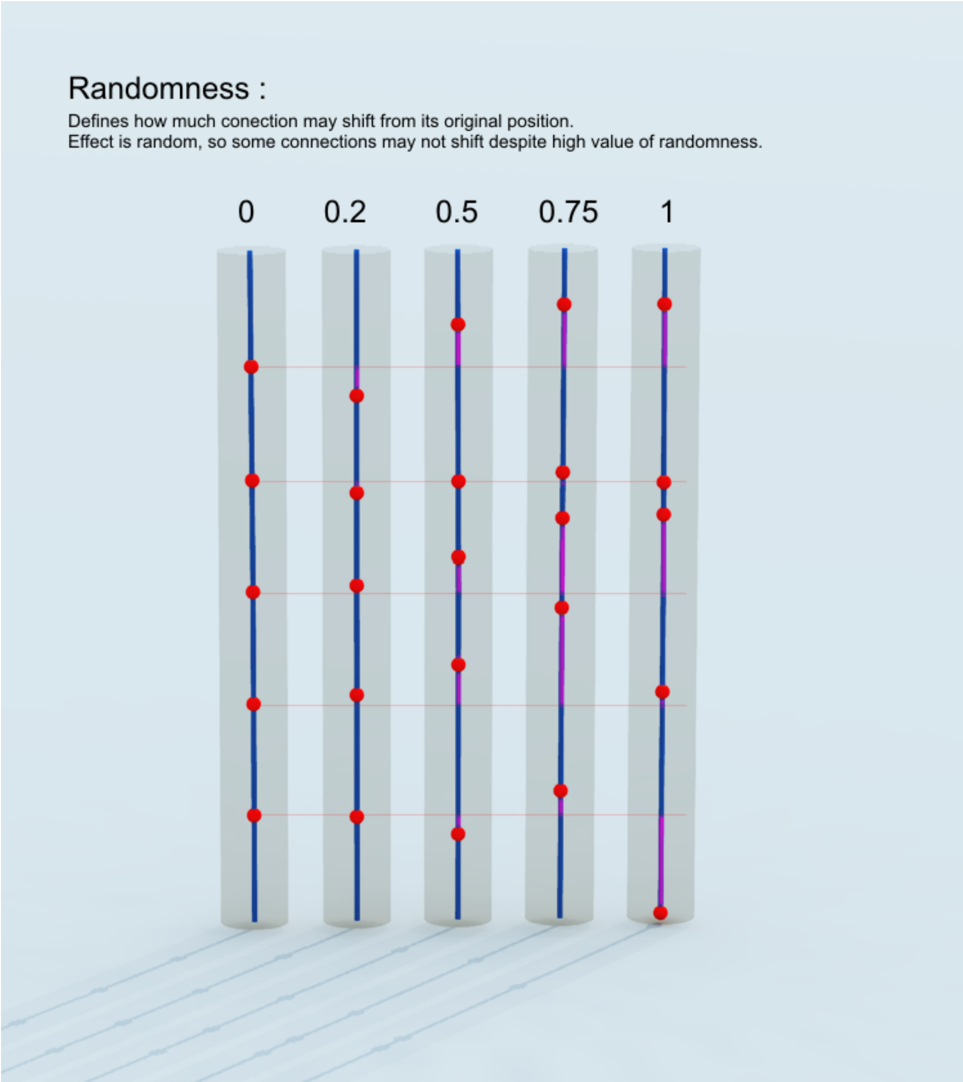
  The higher the value, the more probable it is that a connection will be removed. However **Pruning** is a random effect, so in rare cases it may happen that you can get the opposite – at high pruning values few or even no connection removed or at low pruning values many connections are removed. Usually moderate values of pruning should be used. If you want to remove all connections, it is wiser to define proper start-end range or appropriate distribution curve.
  When whorl effect is defined (multiple instances per connection), then pruning acts per instance – ex. it may prune two instances from 5 present in one connection.



Pruning removes connections

- **Randomness:** Shifts connections along segment axis away from their original position.

  The effect is random, so despite high randomness should shift more, it may happen that in some rare cases the opposite happens.



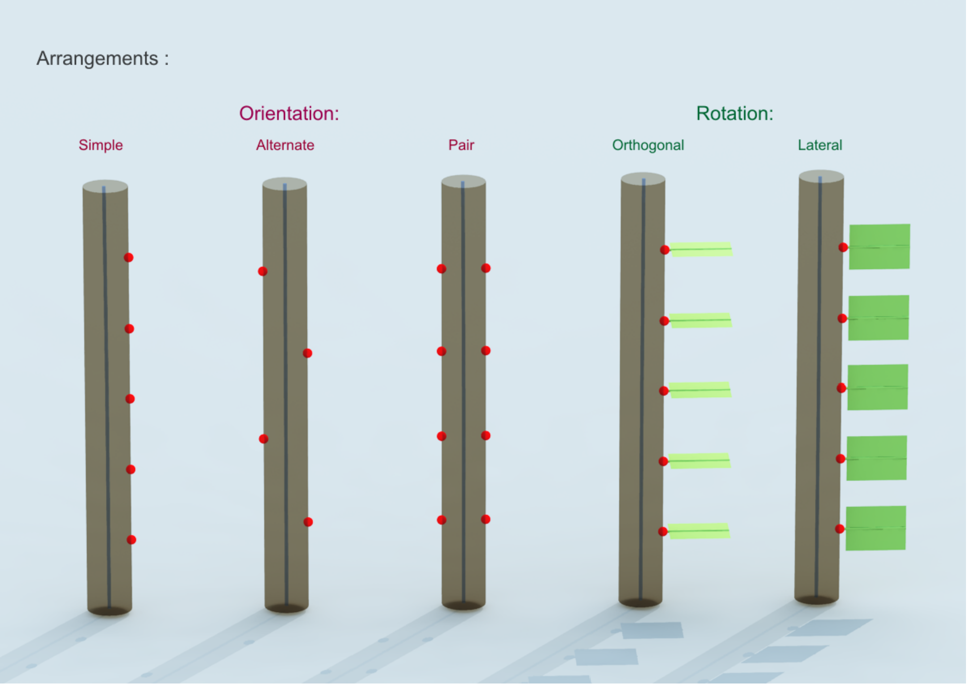
Randomness shifts connections

Placement

These parameters describe how the child primitive instances should be starting and in which way. Here you define where connections should be placed: on axis, side or top of segment, and how they should be arranged.

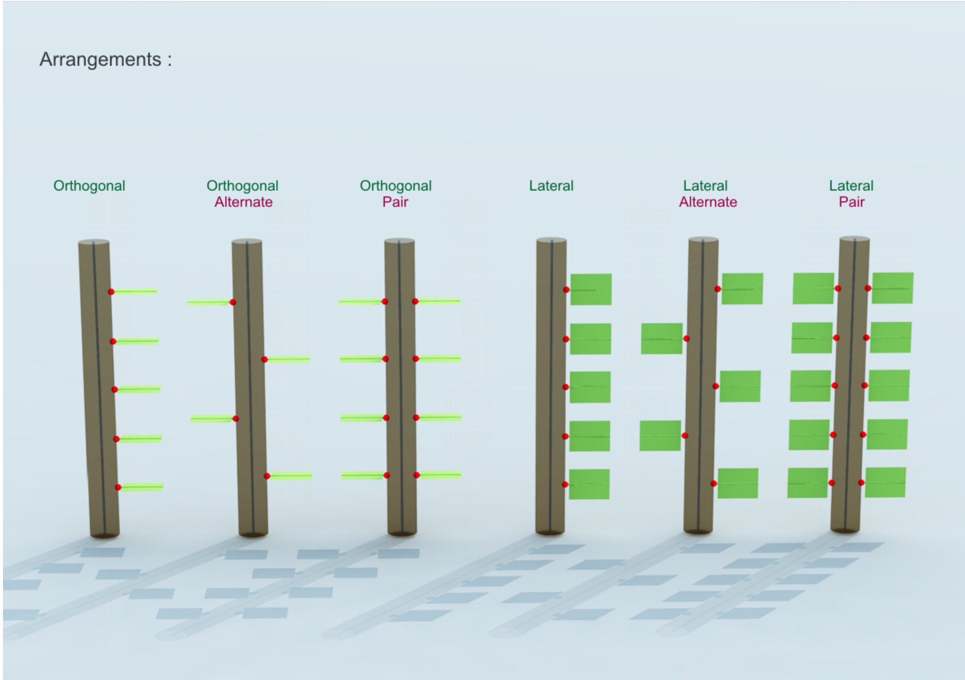
- **Arrangement:** Defines how connections are arranged if placed on segment axis or segment skin.

Arrangement has no effect if top placement is selected.



Explanation

Here the different arrangement types:



Types

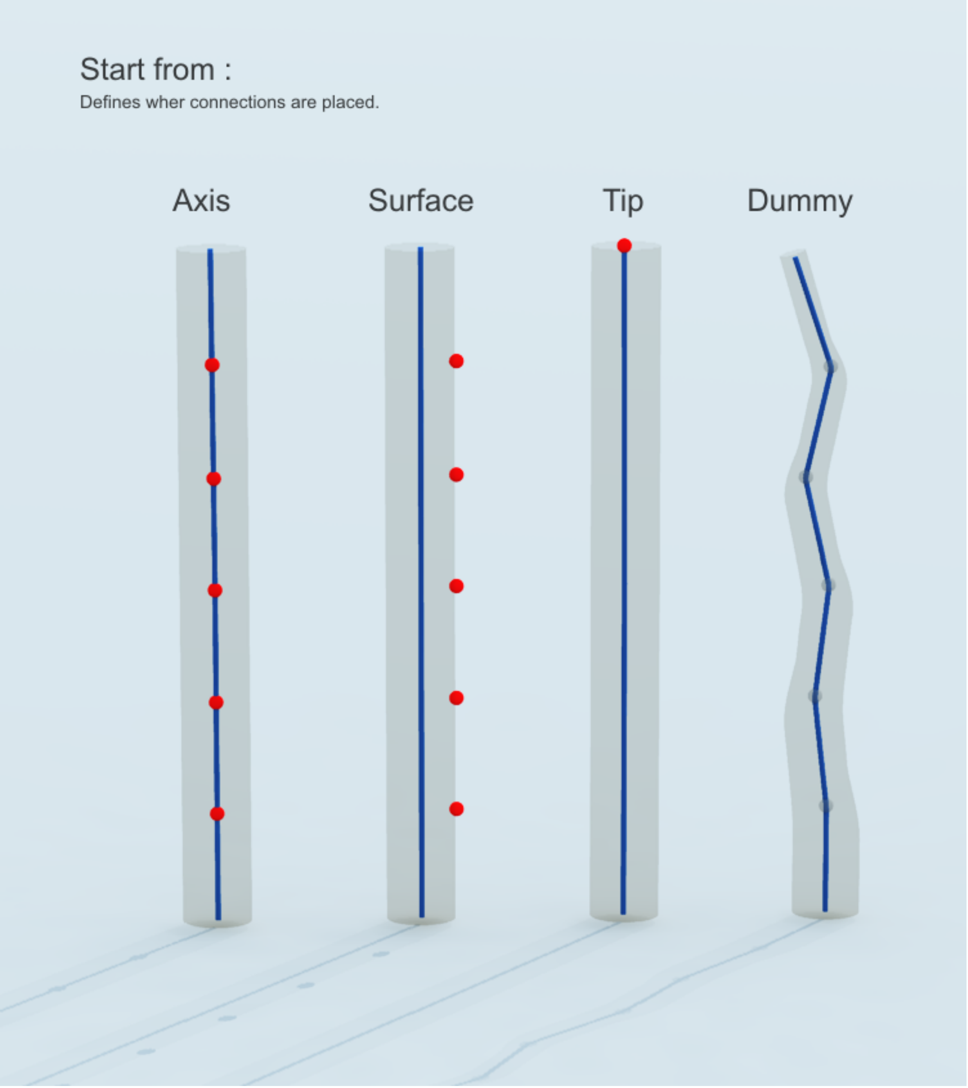
- **Start from:** Defines placement of connections on segment.
  Connections can be placed on :

  – on top (**Tip of the segment**)

  – on axis (**Axis of the segment**)

  – on skin (**Surface of the segment**)

  – dummy connections can be created just to influence segment. (**Only influence, no children**).



Tytpes of connections placements

Since what is selected here is paramount for connections aspect (ex. top/skin position), this parameter should be considered as most important, and it should be defined before any other parameters in connections tab.

If the "tip" option is selected, most of parameters will become inactivated, as they have no meaning for the top position.

- **Move out:** Shifts the connection in/out along the connection orientation vector. This is useful for precise adjustment of connected items placement on segment surface. This parameter works for axis and surface placement and has no effect for tip placement.

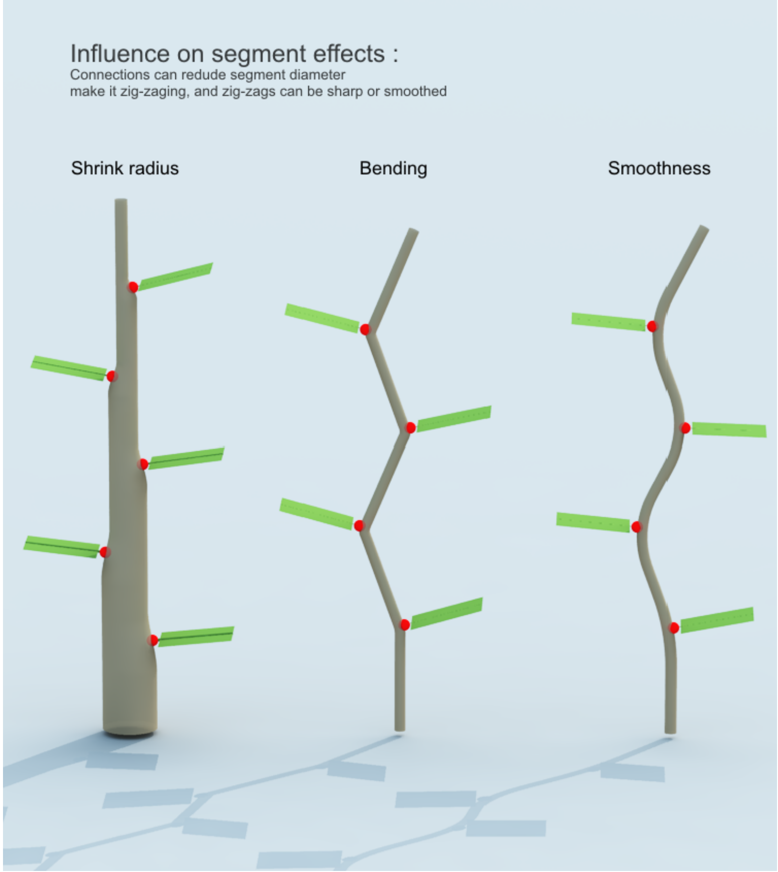
Blending

This section is used to create smooth transitions from the parent to the offspring segments.

- **Use subdivision surfaces:** use subdision surfaces to merge branch geometry and child geometry (only available with quad subdivisions)
- **Upper width:** how wide at the upper boundary the blending is.
- **Lower width:** how wide at the lower boundary the blending is.
- **Child width:** how long the blending between parent and current segment is.
- **Move away:** moves the point where the trunk and brach materials blend away from the parent and down onto the child.
- **Blend materials:** width of the area where parent and child materials blend away from the parent and down onto the child.
- **Normal blend:** defines the shape of the blending (see Filter parameter).

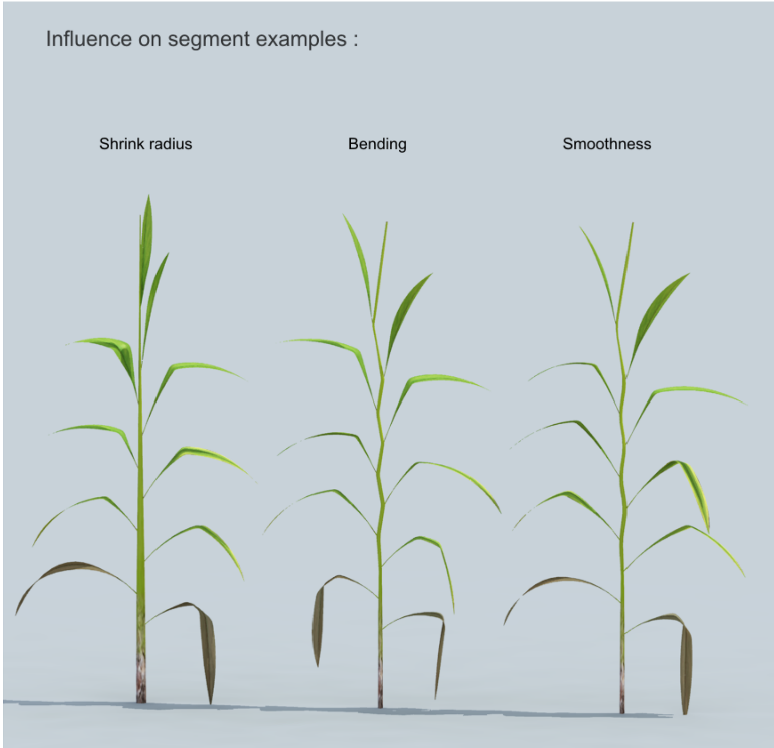
Influence on segment

Parameters that control the action of the child primitive instances on the segment axis.



Influence on radius & zig-zag effect

Here some examples:

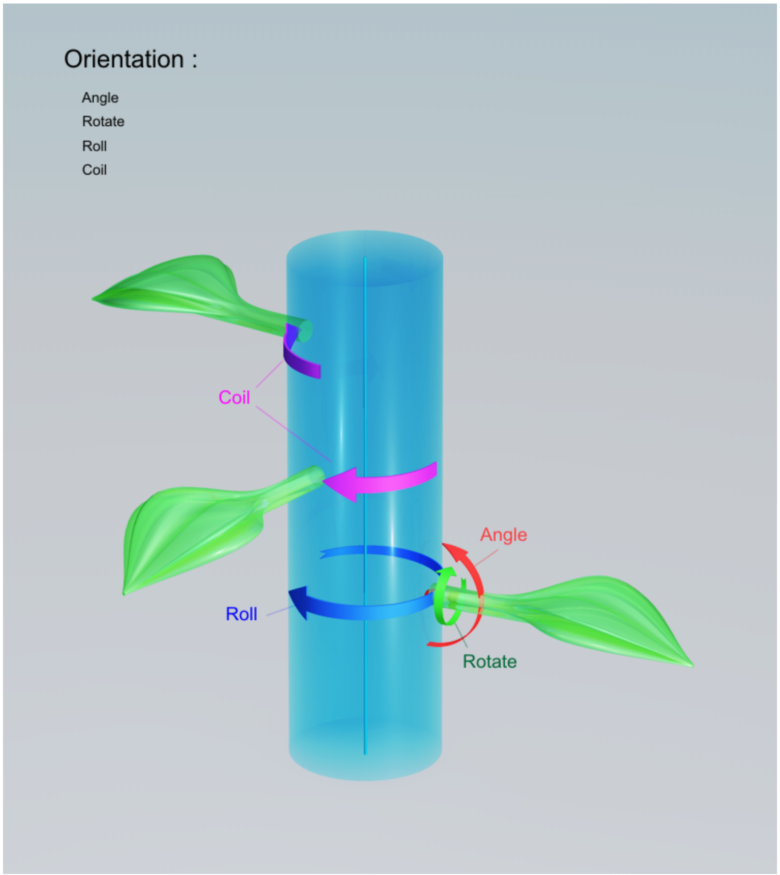


Examples

- **Shrink radius:** Reduces segment radius at connection point. Such effect naturally occurs on trees – trunk section surface gets reduced by the surface of branches growing from it.
- **Bending:** Allows to obtain a zig-zagging shape of segment if the connections are in alternate arrangement. Such effect occurs in nature and is mainly visible on smaller plants or twigs with leaves.
- **Smoothness:** Smoothes the angles between zig-zagging sections. Obviously the bending effect must be defined also.

Orientation

These parameters control how the child primitive instances should be turned with respect to the segment.



Angle, Rotation, Roll, Coil

- **Angle:** Tilts the child primitive instances up and down towards the segment by the given angle in degrees.

  At 0° the segment is orthogonal to its parent primitive instance, at -90° or 90° it is parallel to it. The angle needs to be defined almost in every case. By default it is 30 deg.

  If the connection is on the segment tip, and you need a straight segment there, then you have to set angle to 0°.

- **Rotation:** Rotates the child primitive instances around their local Z axis by an angle in degrees. If the child primitives are just straight cylinders, you won't notice any effect, as cylinders look the same if rotated around their axis. But when you have a segment with blades or other segments connected to it, the effect of rotation will be perfectly visible.

- **Roll:** Rolls child primitive instances around the segment by an angle in degrees. If child primitives are arranged in pairs or alternate, then primitives on opposite sides will roll in opposite directions.
- **Coil:** Rolls child primitive instances around the segment like **Roll**, but acting step by step, from one connection to another.

  While roll rolls all branches by the same angle, coil rolls the next branch by the coil angle from previous one, and so on. Coil should be rather used with branches with simple arrangement, as if branches are arranged in pairs or alternate, then branches on opposite sides will roll in opposite directions, and result may quickly become chaotic. If you need opposite branches to roll in same direction, then consider using simple arrangement and whorl section with 2 instances per connection.

  With Coil you can easily get an effect of spiraling branches, or phyllotaxis arrangement if a 137.5° angle is used.
- **Avoid mesh:** In case an object to grow on has been defined and the segment is near this object, enabling this parameter results in children not growing straight into the object.

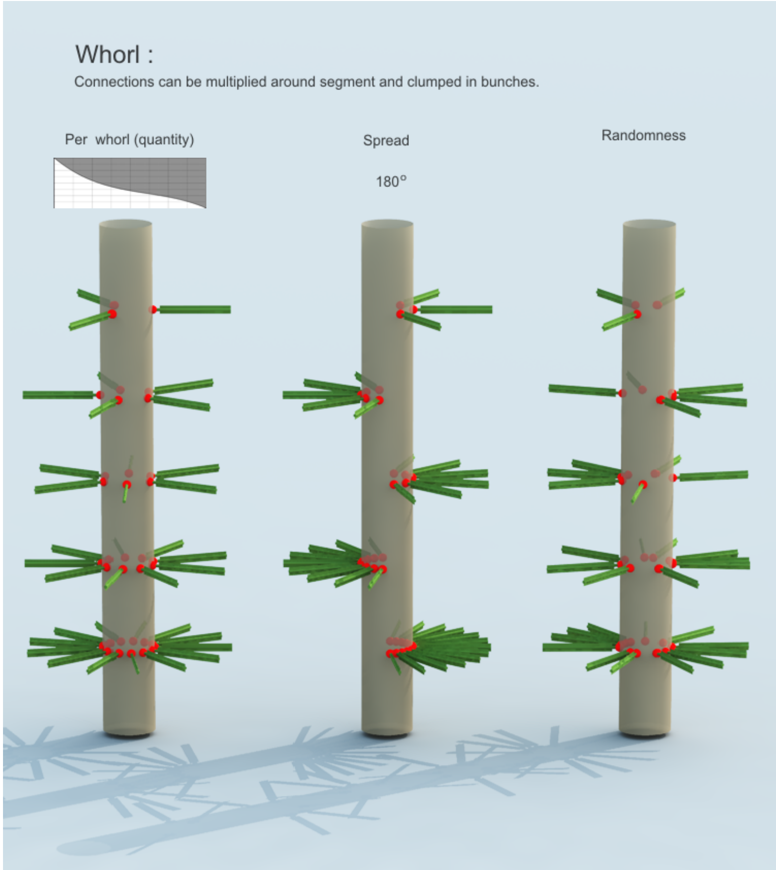
Horizontropism

Parameters that turn children in an horizontal direction. Plant leaves often tend to position themselves horizontally. This Horizontropism section aims at simulating such behavior. With the 3 parameters in this section you can define which should be the preferred way for the connection to try to become horizontal.

- **Angle:** Tilts the child primitive instances up and down towards the segment to make them as horizontal as possible.
- **Rotation:** Rotates the child primitive instances around their local Z axis to make them as horizontal as possible.
- **Roll:** Rolls child primitive instances around the segment to make them as horizontal as possible.

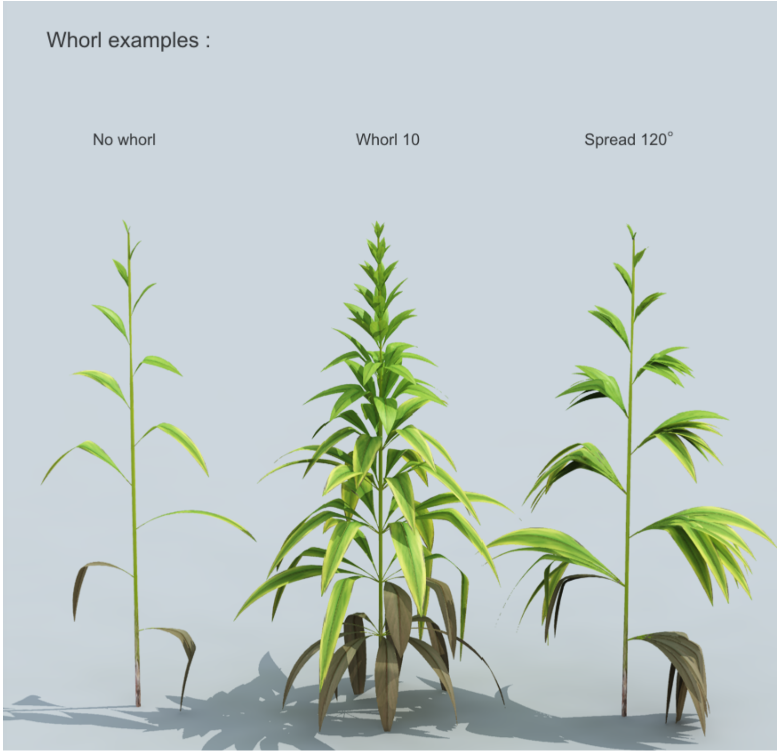
Whorl

Defines multiple instances growing from one connection point. Such effect is typical to conifers, when multiple branches grow at the same height of the bark. Imagine it like an adaptor socket allowing to connect multiple cables to one wall socket.



Whorl number, Spread, Randomness

Here some examples:



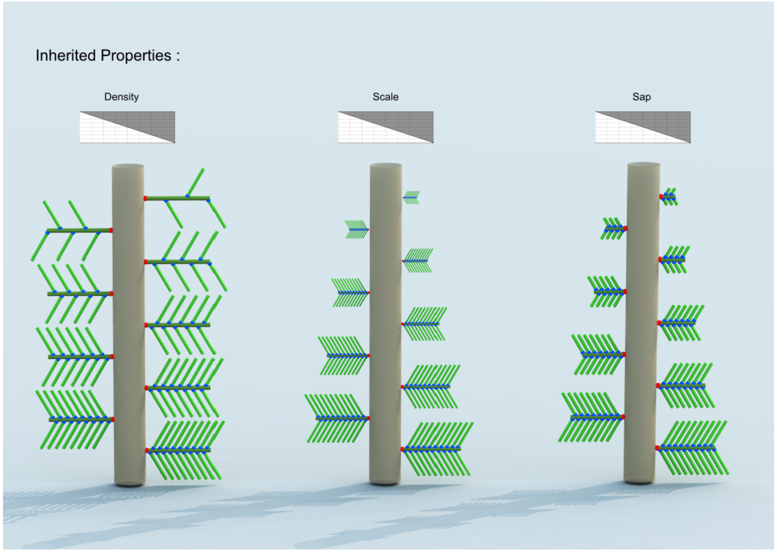
Examples

- **Per whorl:** Defines the number of instances growing from one connection point.
- **Soft insert:** Controls the children distribution behavior in case the per whorl number has a fractional part. To some point this can simulate the growth of child branches on parent branch.
  - **None, use rounded number:** the per whorl number fractional part is removed.
  - **Scale down fractional part:** an extra child instance is generated and its dimensions (length, radius, scale...) are scaled down according to the fractional part of the per whorl number.
  - **Random:** an extra child instance is generated randomly according to the fractional part of the per whorl number.
- **Spread:** Radial spread of instances around the segment section. By default it is 360°, which means that instances will grow all around the segment, but you can limit this value to have instances growing in a more directional range.

- **Randomness:** Randomness of the radial position.

Inherited properties

The properties in this section are passed to child nodes : child nodes inherit those properties from parent node.

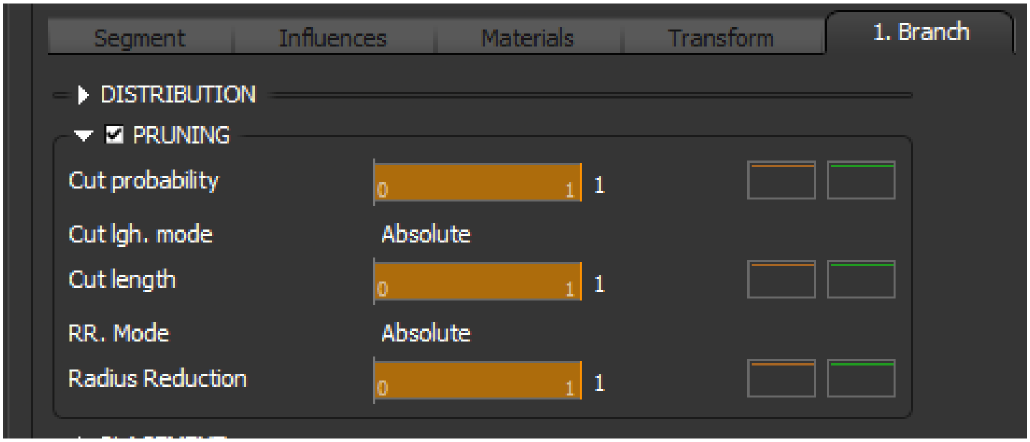


Density, Scale, Sap

- **Density:** Manages the number of connections on the offspring. It can only reduce the number originally defined, not boost it.
- **Scale:** Scales the offspring up or down. Their shape is maintained, only size changes.
- **Sap:** Sap is intended to simulate plant growth. It manages the length of the offspring and their density. On shorter offspring there will be less connections. Like density, it can only make offspring shorter, not boost their length. At 1 you get original size offspring, at 0 the offspring length is reduced to zero.

Pruning

The pruning allows to cut the children of the current segment.



%Eon.Documentation.Modifying.Plants:.Using.Parameters.Geometry. of cut

The probability of cut allows to define if a child segment must be cut or not. Setting this value to 0 results in no cut at all. Setting it to 1 results in cutting all children segments at the length defined by **cut length**.

Cut length

The **cut length** defines at which length the child segment will be cut (when the draw of the **Probability of cut** parameter for the child results in a cut).

Those two parameters can be controlled using the **primal** and **section angle** nodes, and also with the new **Current primitive** node. This node introduces new tools like the **Child direction** which allows to cut thing depending on the direction of the child segment, or the **horizon-tropic azimuth**, which allows to control things around a segment (similarly to the **section angle**), but with the 0 always pointing up.

For instance to create a basic cut with a cone shape, connect the **Absolute primal** to the **Cut length** and set the **Probability of cut** to 1.

Radius reduction

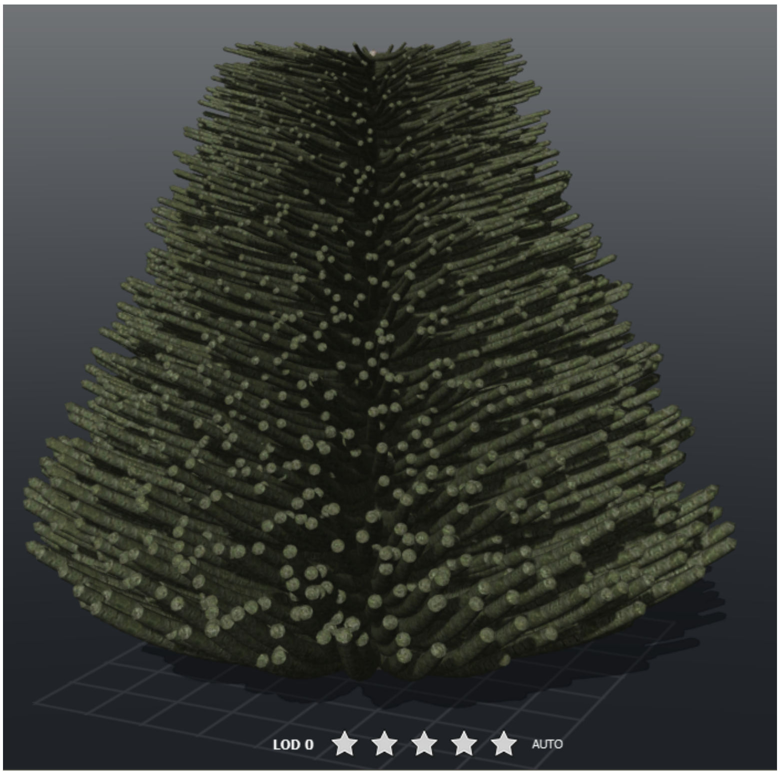
This parameter allows to reduce the diameter of cut branches to simulate the fact that they don't grow anymore after a cut.

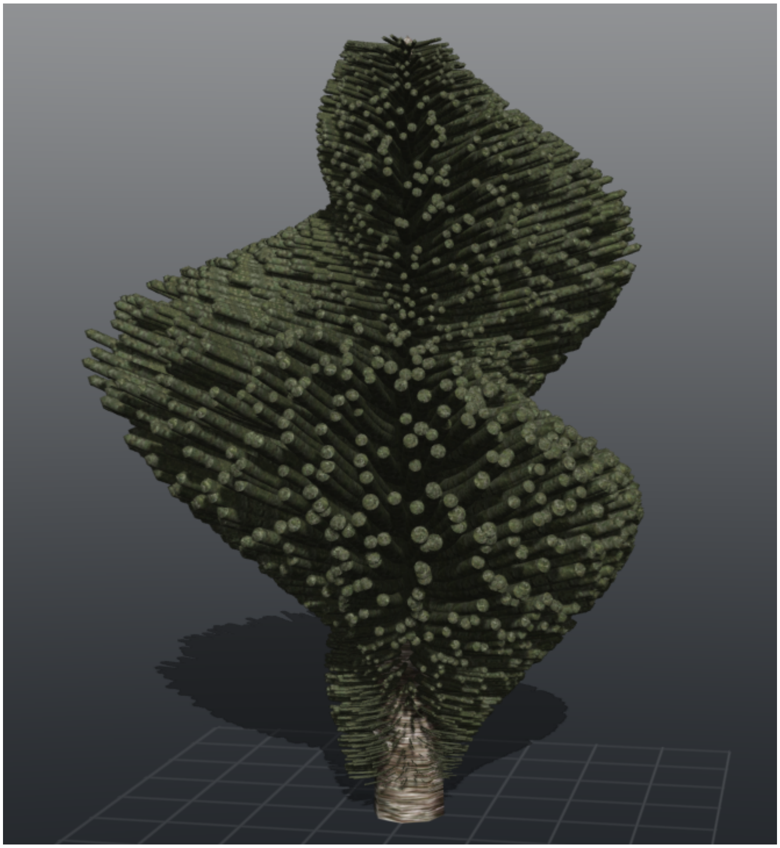
This is a multiplicative factor applied to the "non cut" diameter of the branch.

Cut length example

This show a base plant (a trunk with a lots of branches) before and after pruning.

The **cut length** is defined using the **primal** and **section angle** parameters to create a spiral.

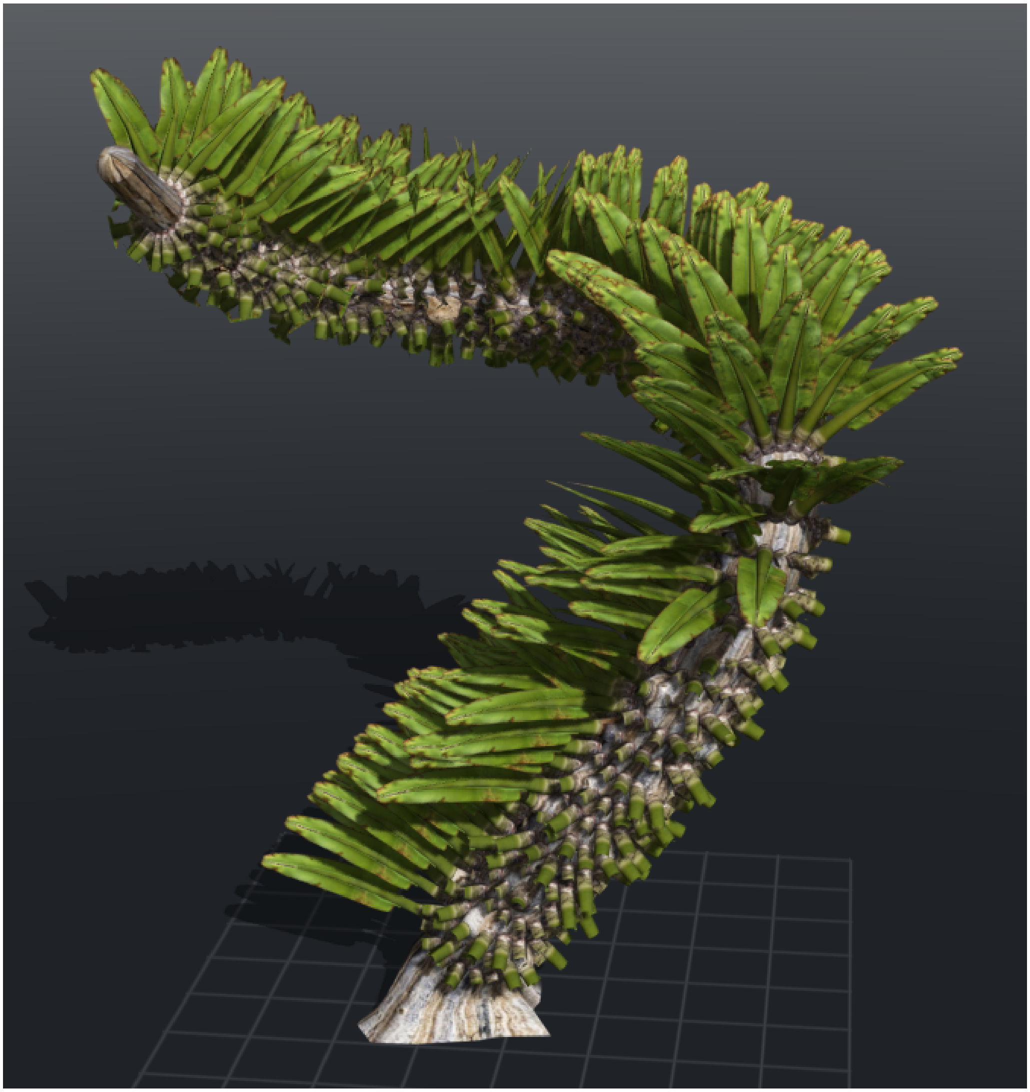




Directional pruning example

Using the **Azimuth (navite)** output of the **Current primitive** node you can prune things following the meridians of the segment:

But using the **Horizontropic Azimuth** the pruning can be done with respect to global directions (here to keep things on the top the surface of the segment).



AutoGrowth

The **AutoGrowth** node generates geometry using a growth simulation inspired from biologic models. The simulation depends on parameters such as age, shadow sensitivity, apical preference, decay, cuts...

Basic usage

Starting from a blank graph :

Create an AutoGrowth node and connect its input to the root node. Also connect the Iteration slot to the Age node.

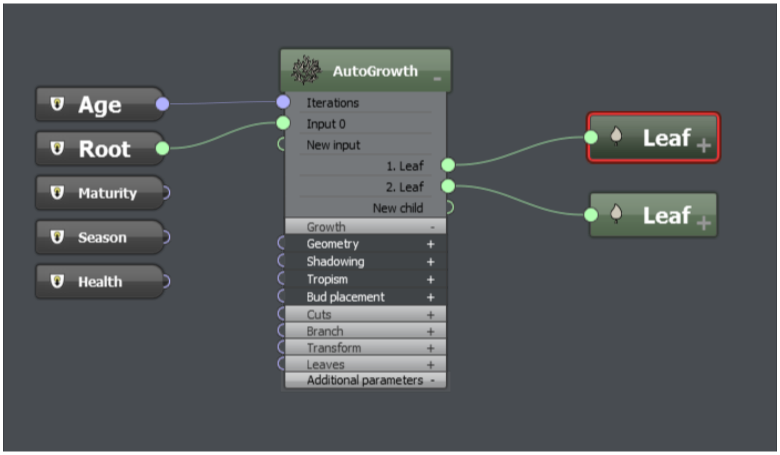
You should see a small tree without leaves.

Create a Leaf node, then set the transform size to 0.15 to reduce the leaf size.

Connect it to the AutoGrowth node.

You should see a small tree with a dozen leaves.

Alternatively you can plug the AutoGrowth node over a Trunk or branch node. Thus you provide the basic structure of the tree, and let the growth complete the small details.



Material parameter group

Inputs

Iterations slot

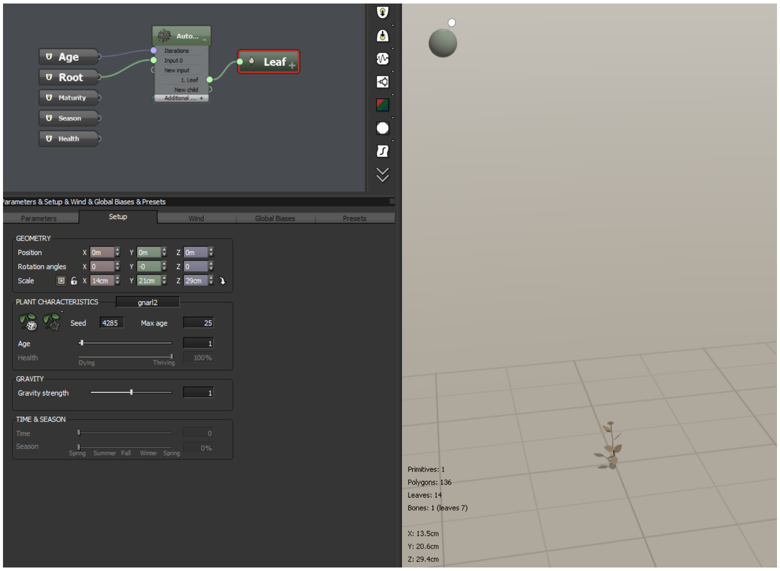
This is the main parameter for the Growth simulation.

By default it's linked directly to the Age node, but you can change this.

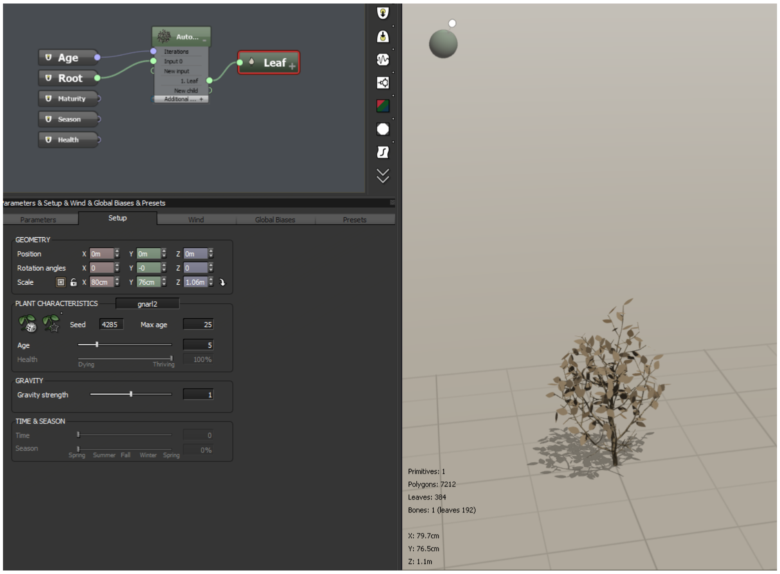
It's a number of iteration, each iteration corresponding to buds transforming into new branches.

You should start with small values (5-10) at the beginning to be able to see quickly the influence of the other parameters. Then when you're happy with the result, you can push it to higher values (up to 50 is reasonable).

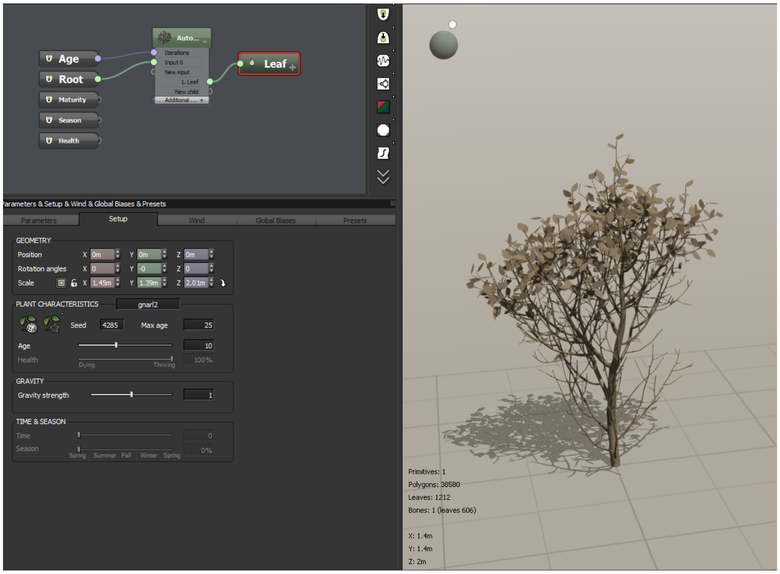
Iterations influence


Age
Root
Maturity
Season
Health
Auto...
Leaf
Parameters & Setup & Wind & Global Biases & Presets
GEOMETRY
Position
Rotation angles
Scale
PLANT CHARACTERISTICS
gnarl2
Seed 4285
Max age 25
Age
GRAVITY
Gravity strength
TIME & SEASON
Primitives: 1
Polygons: 136
Leaves: 14
Bones: 1 (leaves 7)
X: 13.5cm
Y: 20.6cm
Z: 29.4cm

1 Iteration


Age
Root
Maturity
Season
Health
Auto...
Leaf
Parameters & Setup & Wind & Global Biases & Presets
GEOMETRY
Position
Rotation angles
Scale
PLANT CHARACTERISTICS
gnarl2
Seed 4285
Max age 25
Age
GRAVITY
Gravity strength
TIME & SEASON
Primitives: 1
Polygons: 7212
Leaves: 384
Bones: 1 (leaves 192)
X: 79.7cm
Y: 76.5cm
Z: 1.1m

5 Iteration



10 Iteration

Input slot

Other input slots define where to start the growth.

You can plug the AutoGrowth node over a Trunk or Branch node.

Note you can only have one AutoGrowth node in the graph for now.

Tips and tricks

Control the parameters with the age

During the growth simulation, the Current Age node can be used to control the other parameters.

This is quite useful to create a variety of shapes and simulate the evolution of the tree. Try controlling the apical, the noise, the gravitropsim, etc...

One effect at a time

If you don't understand parameter effect, start by removing the decay, the shedding, and the shadowing. So that you see clearly the effect of the basic parameters. Then play with shadowing, shedding and decay.

Also start with small trees, it's faster. Push the age later when you like what you have.

Compatibility

The Growth node can only be used once in the graph. Only leaf nodes can be connected on it.

Parameters

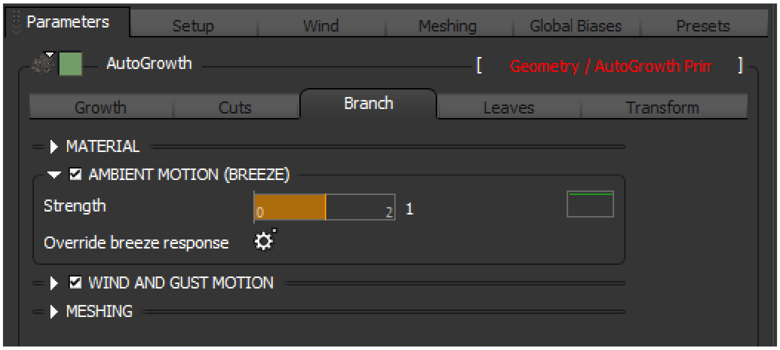
The Autogrowth parameters are split in four tabs:

- Branch Tab
- Cuts Tab
- Growth Tab
- Leaves Tab
- Transform Tab

Branch Tab

- Ambient Motion Group
- Material Group
- Meshing Group
- Wind And Gust Motion

Ambient Motion Group



Ambient Motion group

Strength

This defines the strength of the wind animation for leaves.

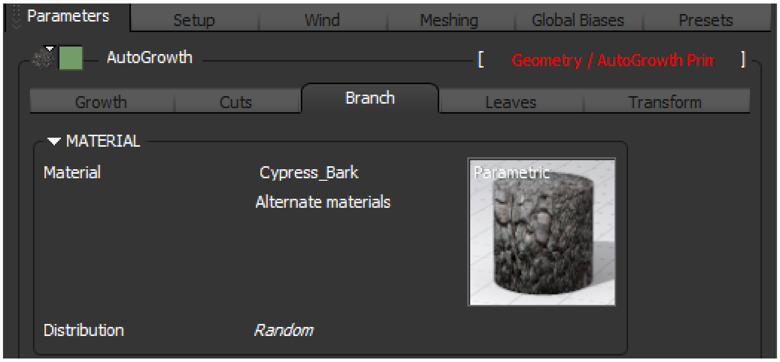
The “Overall influence” in the general Wind setup must also be non zero for this to have an effect.

Override breeze response

This opens a panel which allows to change the leaf animation details for the growth primitive.

See Avanced Breeze Response

Material Group



Material parameter group

Material

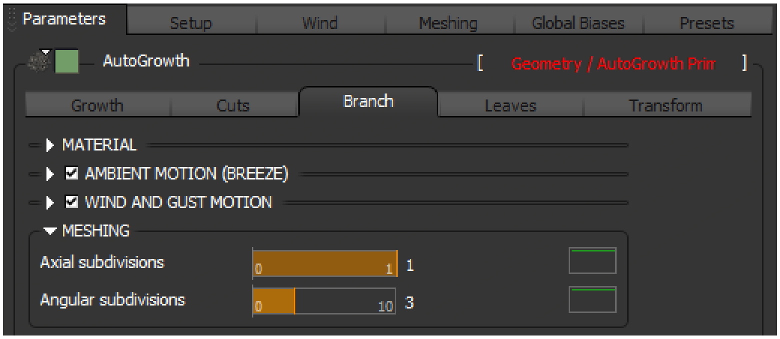
Defines the material for the segment body (see Material parameter).

Distribution

Distribution of the materials of the segment body in case of multiple materials (see Distribution parameter).

Note that only one material is selected from the distribution and applied to all the generated branches.

Meshing Group



Meshing parameter group

Those paremeters are used when the **meshing mode is set to Manual** (in the main Meshing tab).

Axial subdivisions

This is a density of polygons per unit length along the branch axis.

Angular subdivisions

This is a density of polygons per unit length around branches.

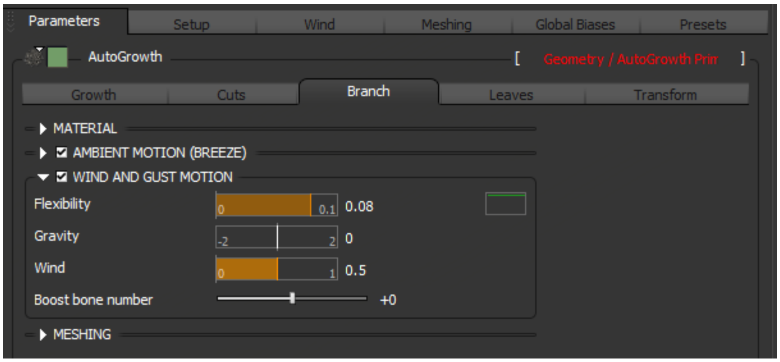
The number of angular subdivisions is equal to the circumference of the branch multiplied by this parameter.

Tips

Set those two parameters at the same value to have approximately square polygons.

This value must be big enough to have an effect : With an Interlength of 0.01, you need to be above 1 / 0.01 = 100 to have detailed polygons.

Wind And Gust Motion



Wind And Gust Motion parameters

These parameters add dynamic deformations on branches and leaves.

Flexibility

Higher flexibility produces larger wind and gravity effect.

Gravity

Gravity effect bends the branches toward the ground when positive, or towards sky when negative.

Wind

Sensitivity to wind.

Bone boost

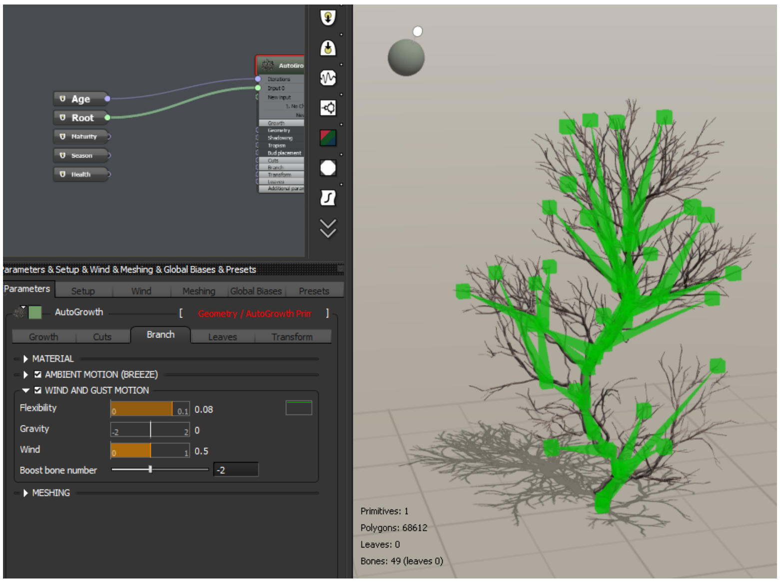
This parameter allows to change the number of bones created for the growth primitives.

- 0 keeps the default value (which is a decreasing function of the number of branches)
- +N multiplies this value by 2 ^ N
- -N divides this value by 2 ^ N

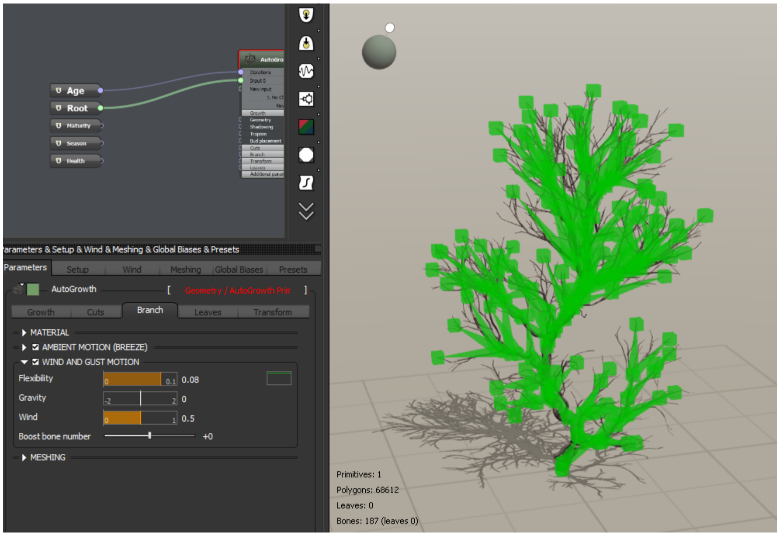
Default value evolution with the number of branches :

- 10 branches -> 9 bones
- 100 branches -> 30 bones
- 10000 branches -> 300 bones
- 1000000 branches -> 3000 bones

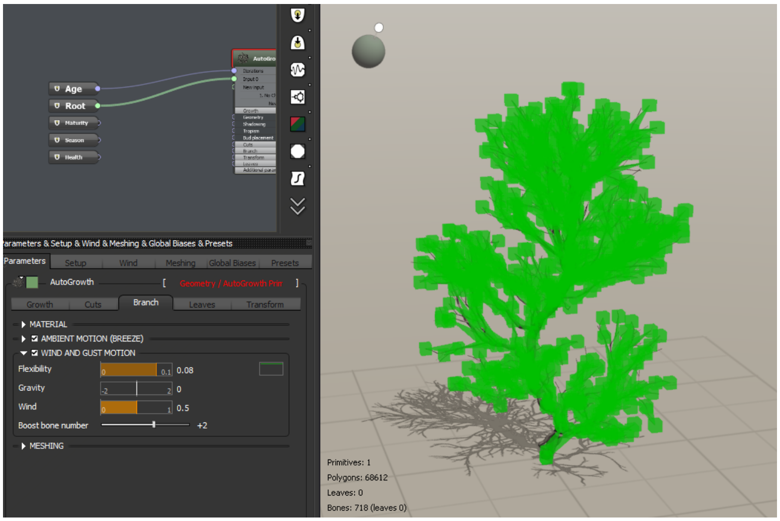
Bone boost



Bone boost -2



Bone boost 0



Bone boost +2

Cuts Tab

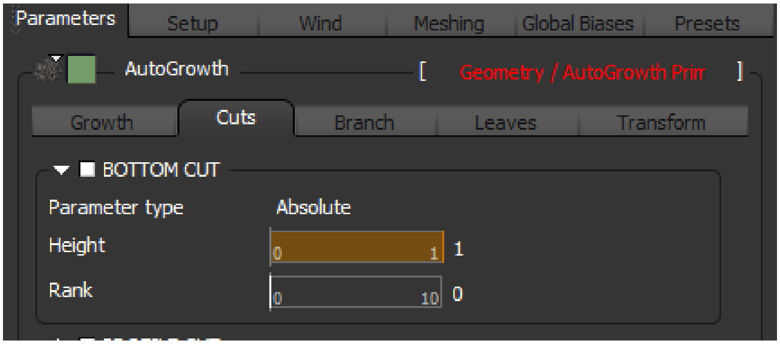
The cut parameters allow to constrain the growth inside shapes.

With this, it's usually better to use growth parameters which produce dense trees, so that the shape is apparent.

- Bottom Cut
- Profile Cut

Bottom Cut

The bottom cut allows to clear the area below a certain height.



Bottom cut parameters

Parameter Type

Absolute : the height parameter is an absolute value.

Relative to height : the height parameter is the proportion of the current plant height.

Rank

When cutting bellow the height threshold, we do not want to cut the trunk.

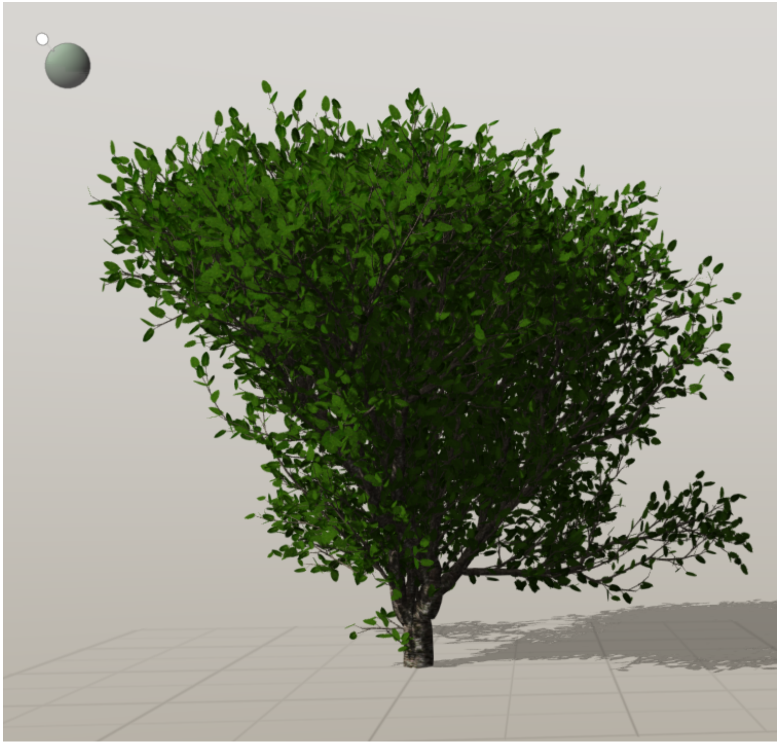
This parameter allows to also not cut the main branches :

- **0:** the default, we only keep the root branch
- **1:** we keep the root branch and its direct children.

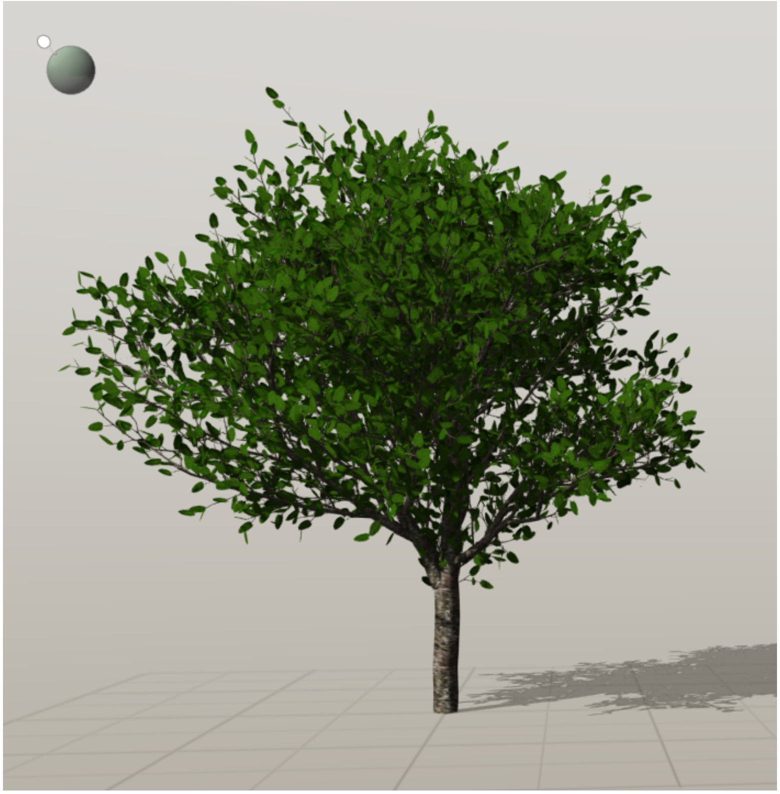
Height

This parameter defines under which height to cut all but the trunk.

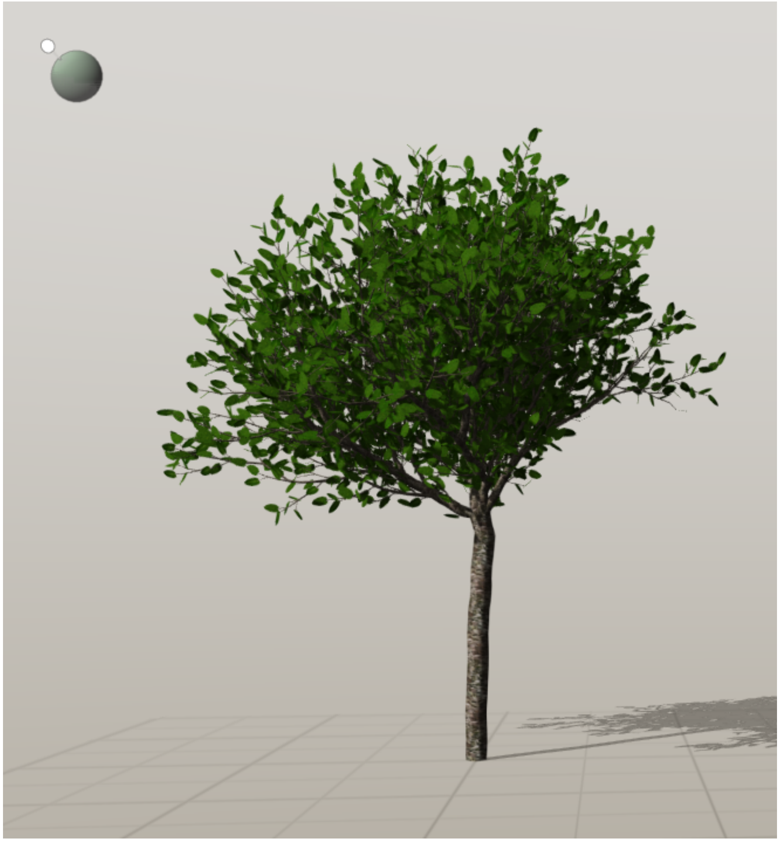
Bottom cut Height



Bottom cut Height 0



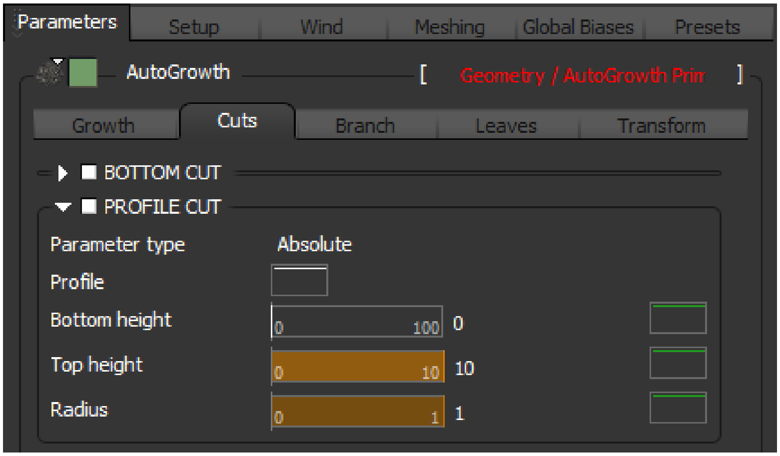
Bottom cut Height 0.5



Bottom cut Height 1

Profile Cut

The Profile Cut parameters allows to give a revolution shape to the tree.



Profile cut parameters

Parameter Type

Absolute : the parameters are absolute value.

Relative to height : the parameters are proportions of the current plant height. **Note that if you cut too much, the plant cannot grow !**

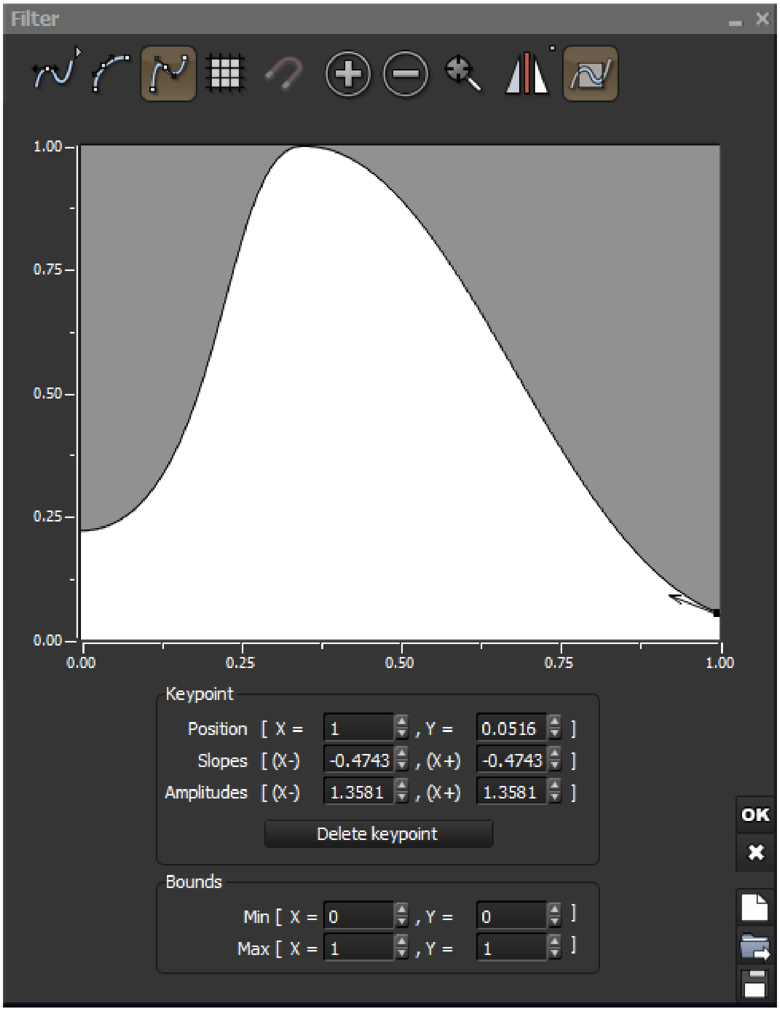
Profile

The profile curve defines the shape of revolution volume (around Z axis).

The left part is the bottom of the plant, the right part the top.

You must start with a non zero value on the left to that the trunk can enter the volume !

On the right, you can either close the volume by using a zero value, or let the plant grow above. (it will create a cylinder on top of the profile).



Profile

Bottom Height

This defines the height associated to the beginning of the profile.

When Parameter Type is “Absolute” : this a length.

When Parameter Type is “Relative to height” : this a proportion of the current plant height.

Top Height

This defines the height associated to the end the profile.

When Parameter Type is “Absolute” : this a length.

When Parameter Type is “Relative to height” : this a proportion of the current plant height.

Tip

When Parameter Type is “Relative to height”, if Top height is too low the plant cannot grow as you cut more than what is growing !

Radius

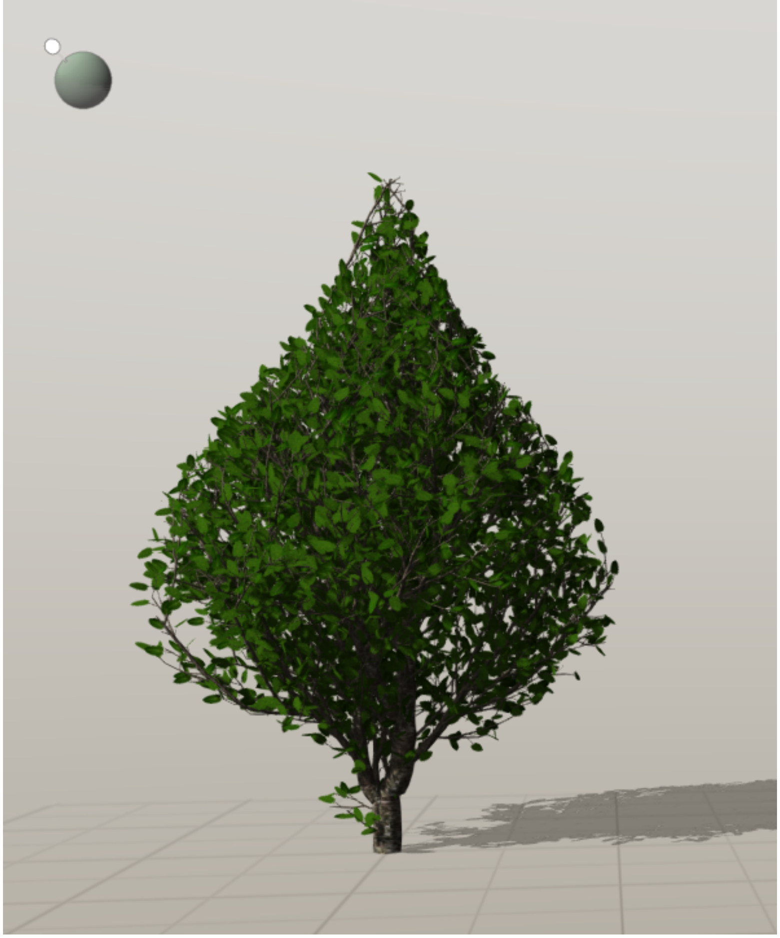
This defines the thickness the profile.

You must have a non zero value on the left to allow the trunk and base branches to enter the cut volume.

You can have a non zero value on the right if you want an open ended cut. Above height max, the cut will be a cylinder.

Profile cut

Profile Cut, Height 2 Radius 2



Profile Cut, Height 3 Radius 1

Growth Tab

- Bud Placement
- Geometry
- Shadowing
- Tropisms

Bud Placement

This defines the tendency of the buds to start from a certain side of a branch.

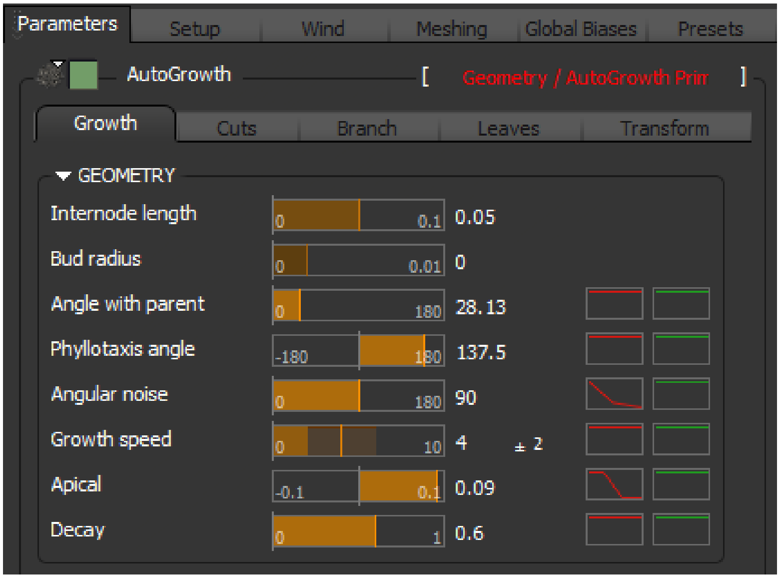
It's relative to the vertical axis.

- **Favor up:** defines a tendency to prefer buds starting from the "top" or "bottom" of a branch.
- **Favor sides:** defines a tendency to prefer buds starting from the "sides" of a branch (instead of "top and bottom" of the branch)

Those parameters can be controlled with the age filter.

They are evaluated once per iteration.

Geometry



Geometry parameters

Internode Length

This parameter defines the elementary length of growth. That's the distance between two buds.

Range : 0.001 to 1, usual value 0.02

This parameter cannot be controlled with other parameters. It is a constant for the current growth algorithm.

Bud Radius

This parameter defines the elementary diameter of branches. That's the initial radius of newly created branches.

The radius of parent branches is computed using a conservation law.

Relation with parent nodes :

Range : 0.0001 to 10, usual value 0.002

Evaluated once (constant for growth).

Tip

When the growth node is connected to a parent trunk or parent branches (whose radius is not controlled by the growth simulation), the radius of grown branches is limited so that it does not gets bigger than the parent radius. Growth of those branches is also limited to keep a coherent tree.

Angle with Parent

This parameter defines the initial angle a branch makes with its parent branch.

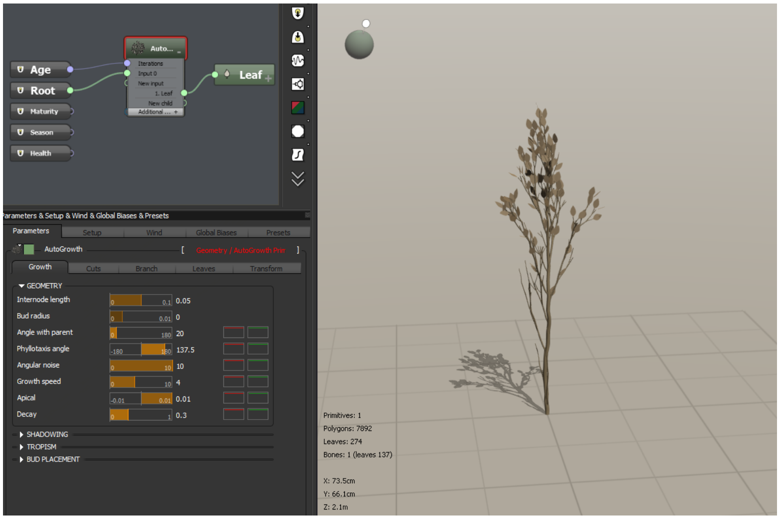
Range : 0 to 180 degrees. 0 for same direction, 180 for opposite direction.

Usual values are between 10 and 90 degrees.

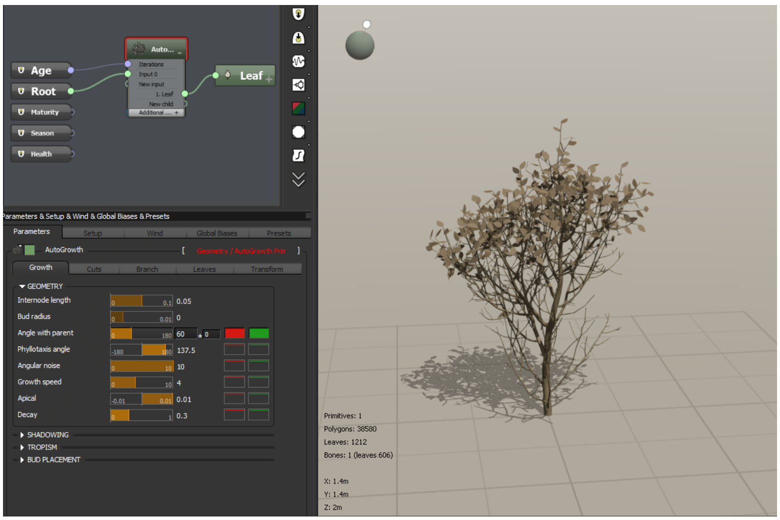
This parameter can be controlled with the age filter.

Evaluated once per growth shoot (a bud transforming to a new branch).

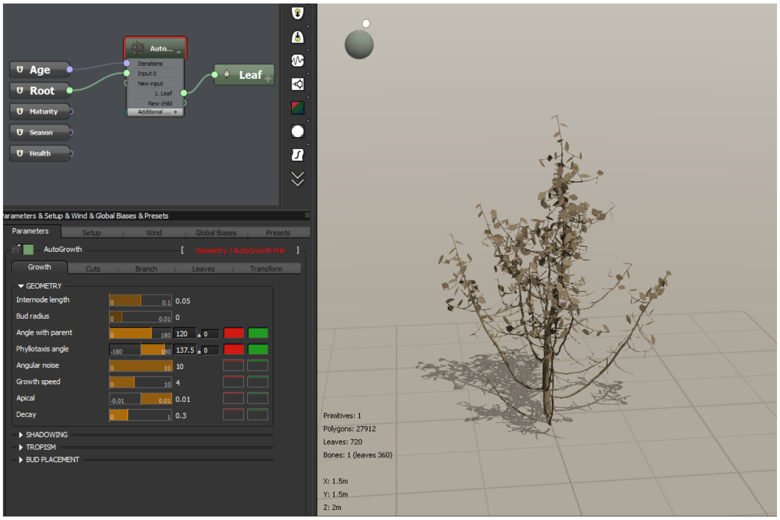
Branch Angle


Age
Root
Maturity
Season
Health
Auto...
Iterations
Input 0
New input
1. Leaf
New child
Additional ...
Leaf
Parameters & Setup & Wind & Global Biases & Presets
Parameters
Setup
Wind
Global Biases
Presets
AutoGrowth
[Geometry / AutoGrowth Pri]
Growth
Cuts
Branch
Leaves
Transform
GEOMETRY
Internode length 0.05
Bud radius 0
Angle with parent 20
Phyllotaxis angle 137.5
Angular noise 10
Growth speed 4
Apical 0.01
Decay 0.3
SHADOWING
TROPISM
BUD PLACEMENT
Primitives: 1
Polygons: 7892
Leaves: 274
Bones: 1 (leaves 137)
X: 73.5cm
Y: 66.1cm
Z: 2.1m

20°


Age
Root
Maturity
Season
Health
Auto...
Iterations
Input 0
New input
1. Leaf
New child
Additional ...
Leaf
Parameters & Setup & Wind & Global Biases & Presets
Parameters
Setup
Wind
Global Biases
Presets
AutoGrowth
[Geometry / AutoGrowth Pri]
Growth
Cuts
Branch
Leaves
Transform
GEOMETRY
Internode length 0.05
Bud radius 0
Angle with parent 60
Phyllotaxis angle 137.5
Angular noise 10
Growth speed 4
Apical 0.01
Decay 0.3
SHADOWING
TROPISM
BUD PLACEMENT
Primitives: 1
Polygons: 38580
Leaves: 1212
Bones: 1 (leaves 606)
X: 1.4m
Y: 1.4m
Z: 2m

60°



120°

Phyllotaxis Angle

This parameter defines the angle between bud or branches around the parent branch. (see https://en.wikipedia.org/wiki/Phyllotaxis)

Range : -180 to 180 degrees. 0 for constant direction, 180 for alternative directions.

Default value is 137.5

This parameter can be controlled with the age and parent filters.

Evaluated once per bud.

Angular Noise

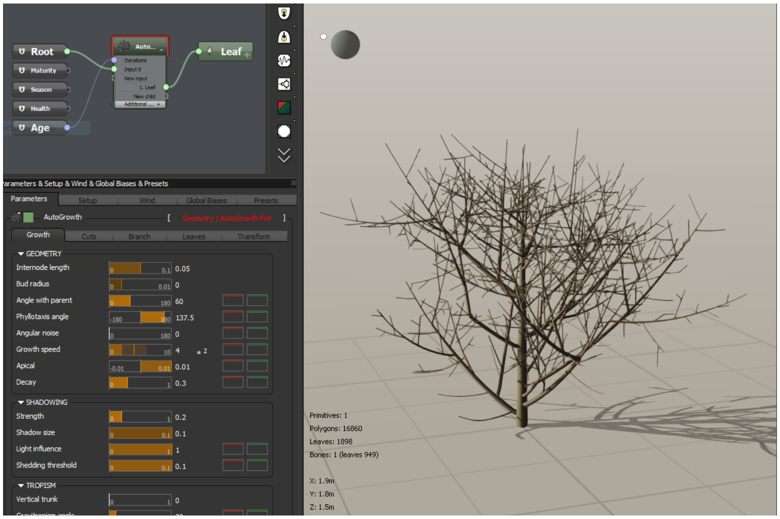
This parameter adds noise to the growing direction of branches.

This parameter can be controlled with the age and parent filter.

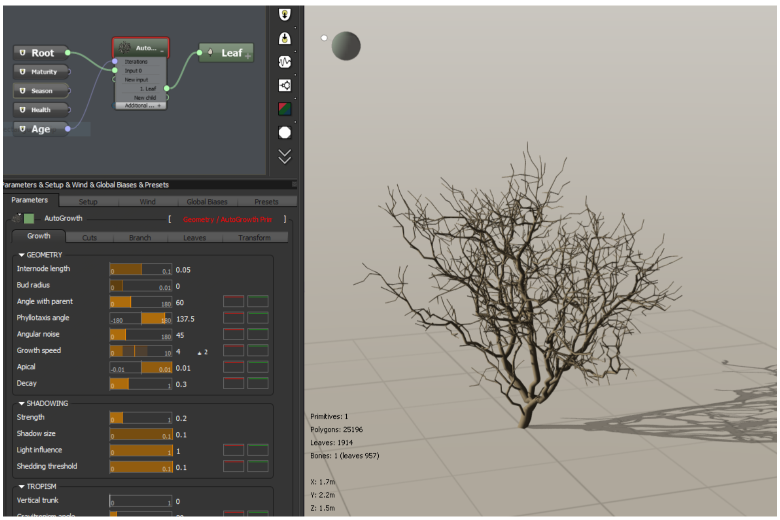
It is evaluated per growth shoot (a bud transforming to a new branch).

Range : 0 to 180 degrees.

Noise



Noise 0°



Noise 45°

Growth Speed

The growth speed parameter controls the maximum length of new branches produced at each growth iteration.

This is the number of buds produced on a new branch or at the end of a growing branch.

Range 1 to 100. Usual values : 3 to 10

Growth Speed can be controlled with the age and parent filters.

It is evaluated once per growth shoot (a bud transforming to a new branch).

Apical

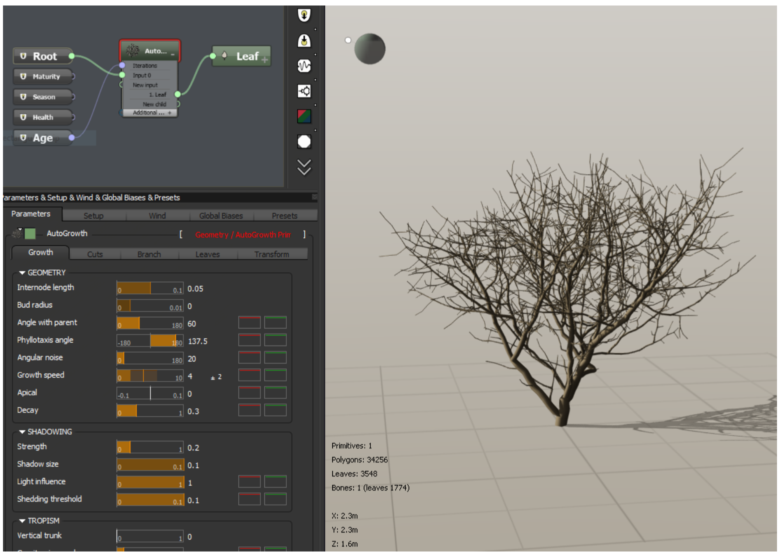
The Apical parameter controls the tendency of a plant to growth more on its main branch than on lateral ones.

Range : -0.1 to 0.1, usual value are positive.

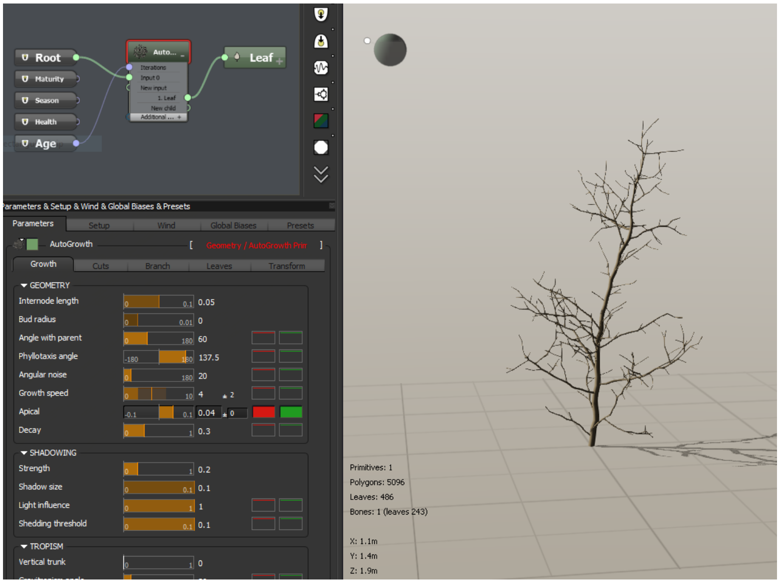
The Apical parameter can be controlled with the age and parent filters.

It is evaluated once per growth iteration.

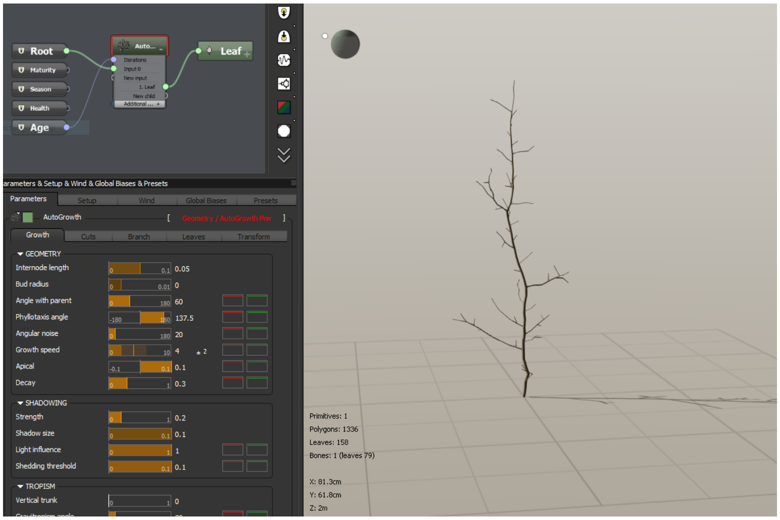
Apical



0


Root
Maturity
Season
Health
Age
Auto...
Leaf
Parameters & Setup & Wind & Global Biases & Presets
Parameters
Setup
Wind
Global Biases
Presets
AutoGrowth
Geometry / AutoGrowth Prim
Growth
Cuts
Branch
Leaves
Transform
GEOMETRY
Internode length 0.05
Bud radius 0
Angle with parent 60
Phyllotaxis angle 137.5
Angular noise 20
Growth speed 4
Apical 0.04
Decay 0.3
SHADOWING
Strength 0.2
Shadow size 0.1
Light influence 1
Shedding threshold 0.1
TROPISM
Vertical trunk 0
Primitives: 1
Polygons: 5096
Leaves: 486
Bones: 1 (leaves 243)
X: 1.1m
Y: 1.4m
Z: 1.9m

0.04


Root
Maturity
Season
Health
Age
Auto...
Leaf
Parameters & Setup & Wind & Global Biases & Presets
Parameters
Setup
Wind
Global Biases
Presets
AutoGrowth
Geometry / AutoGrowth Prim
Growth
Cuts
Branch
Leaves
Transform
GEOMETRY
Internode length 0.05
Bud radius 0
Angle with parent 60
Phyllotaxis angle 137.5
Angular noise 20
Growth speed 4
Apical 0.1
Decay 0.3
SHADOWING
Strength 0.2
Shadow size 0.1
Light influence 1
Shedding threshold 0.1
TROPISM
Vertical trunk 0
Primitives: 1
Polygons: 1336
Leaves: 158
Bones: 1 (leaves 79)
X: 81.3cm
Y: 61.8cm
Z: 2m

0.1

Tip

Using the age filter, you can start with a high value to create a tall trunk, then go back to neutral to develop branches.

Decay

The decay parameter controls the destruction of dead branches over time.

Range 0 to 1.

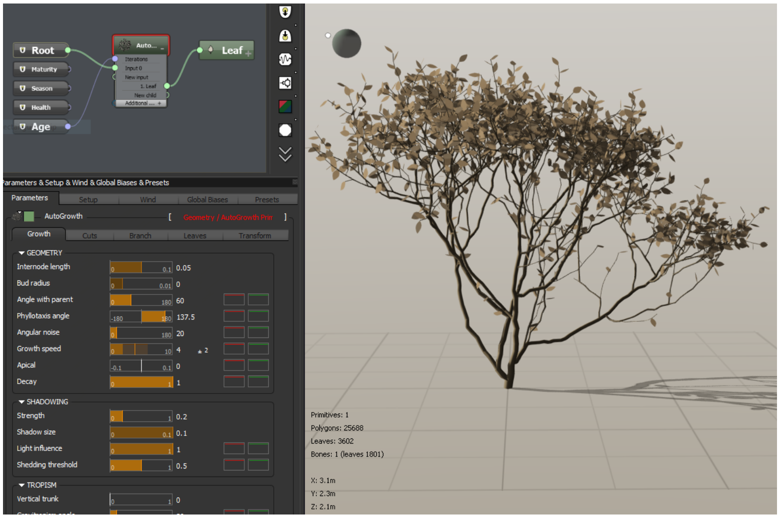
- 0 is no decomposition, all dead branches remain in place (without any leaf)
- 1 is full decomposition, dead branches disappear immediately.

Decay can be controlled with the age filter.

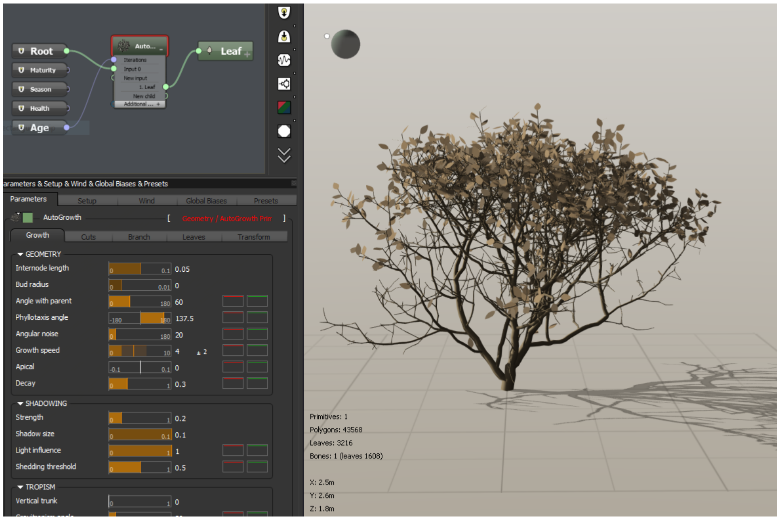
It is evaluated at branch death.

Note the decay has an effect only when the shedding in not zero (otherwise branches never die).

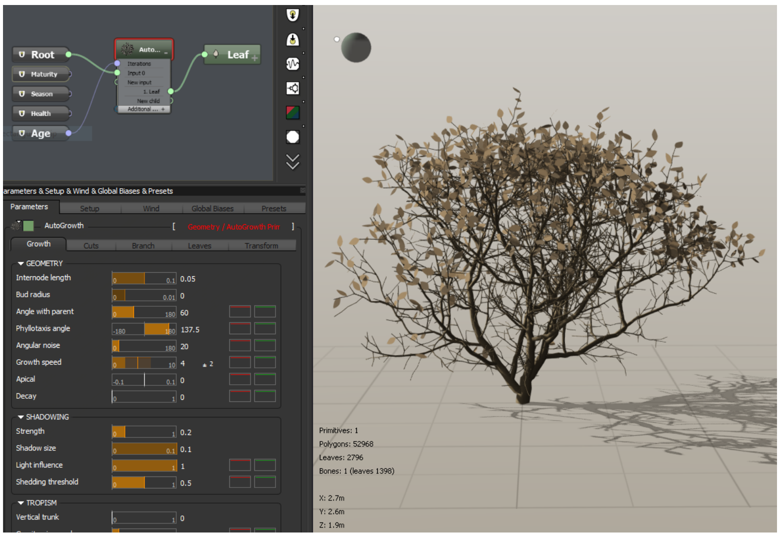
Decay



Full

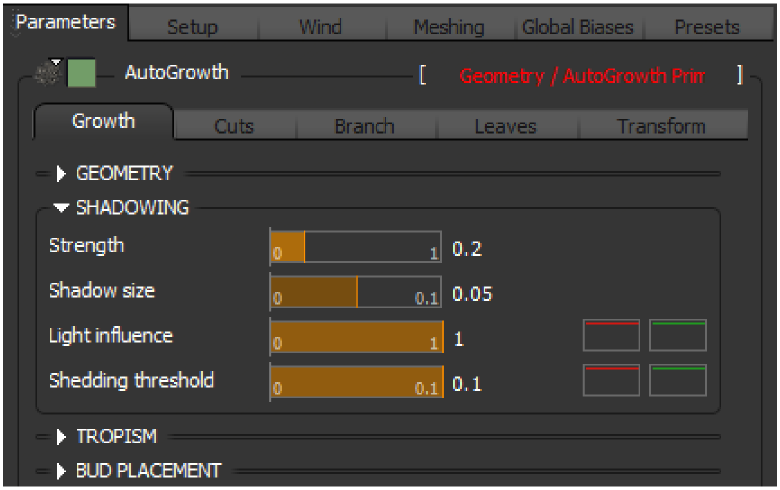

Root
Maturity
Season
Health
Age
Leaf
Parameters
Setup
Wind
Global Biases
Presets
AutoGrowth
Geometry / AutoGrowth Prir
Growth
Cuts
Branch
Leaves
Transform
GEOMETRY
Internode length 0.05
Bud radius 0
Angle with parent 60
Phyllotaxis angle 137.5
Angular noise 20
Growth speed 4
Apical 0
Decay 0.3
SHADOWING
Strength 0.2
Shadow size 0.1
Light influence 1
Shedding threshold 0.5
TROPISM
Vertical trunk 0
Primitives: 1
Polygons: 43568
Leaves: 3216
Bones: 1 (leaves 1608)
X: 2.5m
Y: 2.6m
Z: 1.8m

Medium


Root
Maturity
Season
Health
Age
Leaf
Parameters
Setup
Wind
Global Biases
Presets
AutoGrowth
Geometry / AutoGrowth Prir
Growth
Cuts
Branch
Leaves
Transform
GEOMETRY
Internode length 0.05
Bud radius 0
Angle with parent 60
Phyllotaxis angle 137.5
Angular noise 20
Growth speed 4
Apical 0
Decay 0
SHADOWING
Strength 0.2
Shadow size 0.1
Light influence 1
Shedding threshold 0.5
TROPISM
Vertical trunk 0
Primitives: 1
Polygons: 52968
Leaves: 2796
Bones: 1 (leaves 1398)
X: 2.7m
Y: 2.6m
Z: 1.9m

None

Shadowing



Shadowing parameters

Strength

This parameter has a linear influence on the quantity of shadow generated by leaves.

It should reflect the average texture opacity of the connected leaves.

It must be uniform for the current growth algorithm, so you have to set it.

Shadow size

This is a length used to evaluate leaf shadow. It has a non linear influence.

It should reflect the average size of the leaves.

This must be uniform for the current growth algorithm.

Light Influence

This defines the sensitivity of buds to light.

Range 0 to 10. Normal value 1. Note this is a power law coefficient.

Light influence can be controlled with the age and parent filters.

It is evaluated once per growth iteration.

Shedding Threshold

Controls the death of branches due to missing resources (not enough light).

The quantity of light reaching a leaf is computed using the tree structure and the previous parameters. This allow to compute each branch resource. When below the Shedding Threshold, the branch dies.

The shedding parameter can be controlled with the age and parent filters.

It is evaluated once per growth iteration.

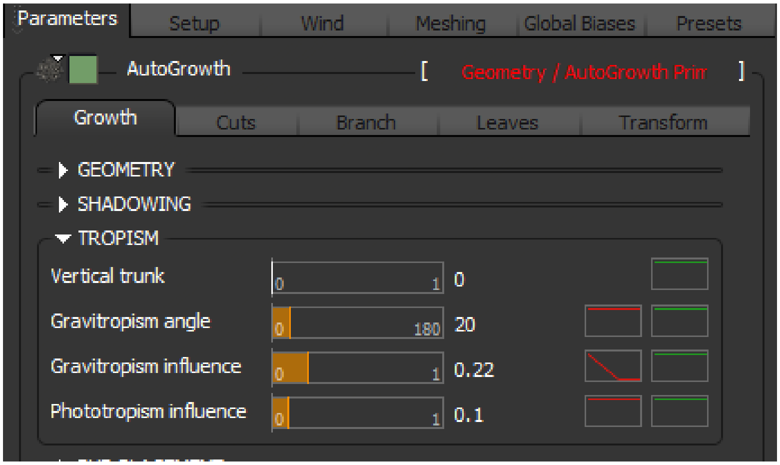
Range : 0 to 1, 0 is no death

Tropisms

When starting from a bud, a branch grows initially in the bud direction.

But then it turns slowly towards a different direction which is controlled by tropism parameters.

For now we have two kinds of tropisms used in the growth simulation, but others might be added later.



Tropism parameters

Gravitropism

Gravitropism is the tendency of a branch to grow with a certain angle with respect to the vertical axis.

Gravitropism Influence

This parameter controls the strength of the Gravitropism effect.

Range : 0 to 1.

This parameter can be controlled by the age and parent filters.

It is evaluated once per growth iteration.

Gravitropism Angle

This parameter defines the target angle of the Gravitropism effect.

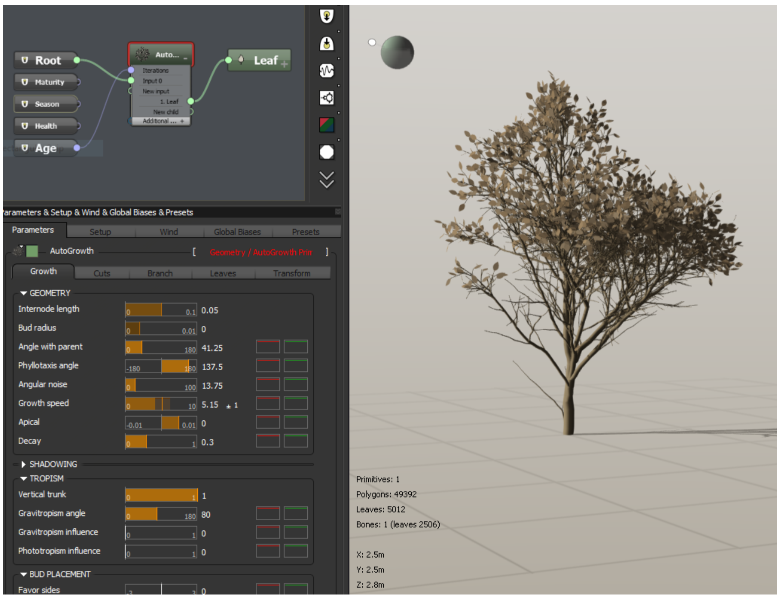
It's an angle relative to zenith.

Range : 0 to 180 degrees. O is Zenith, 180 is ground

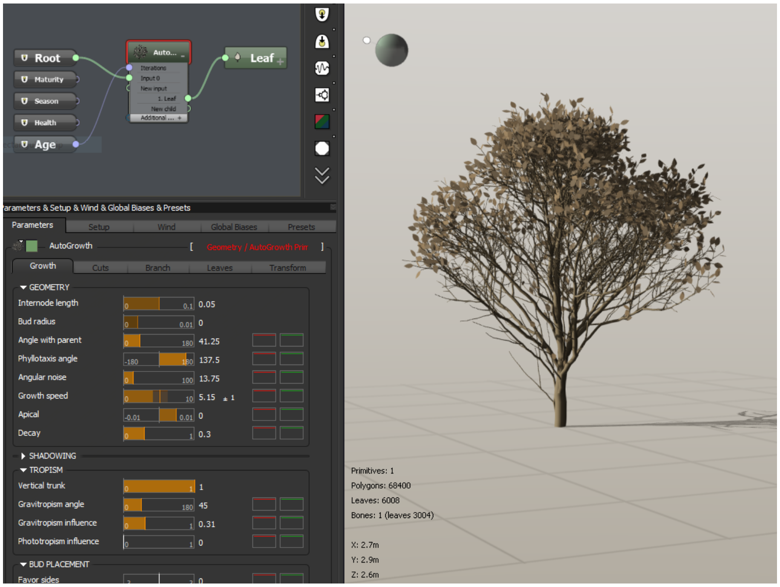
This parameter can be controlled by the age and parent filters.

It is evaluated once per growth iteration.

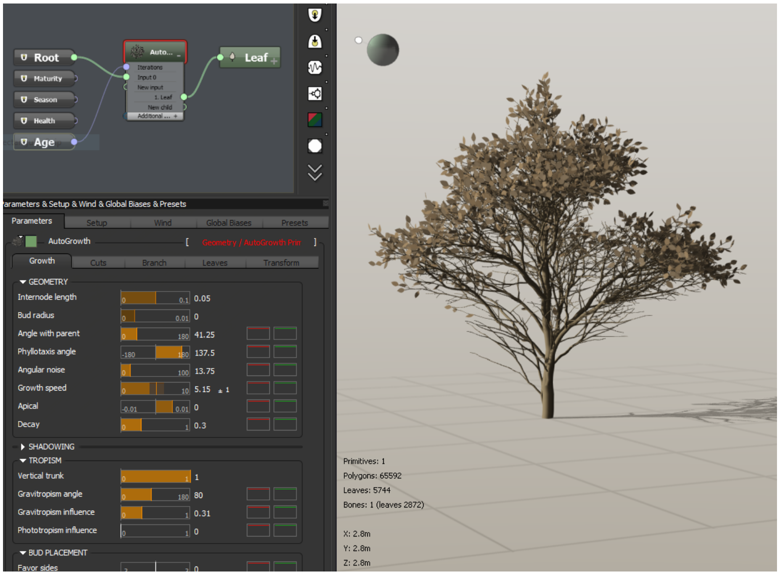
Gravitropism



No gravitropism



Gravitropism 45°



Gravitropism 80°

Phototropism Influence

Phototropism is the tendency of a branch to grow towards light.

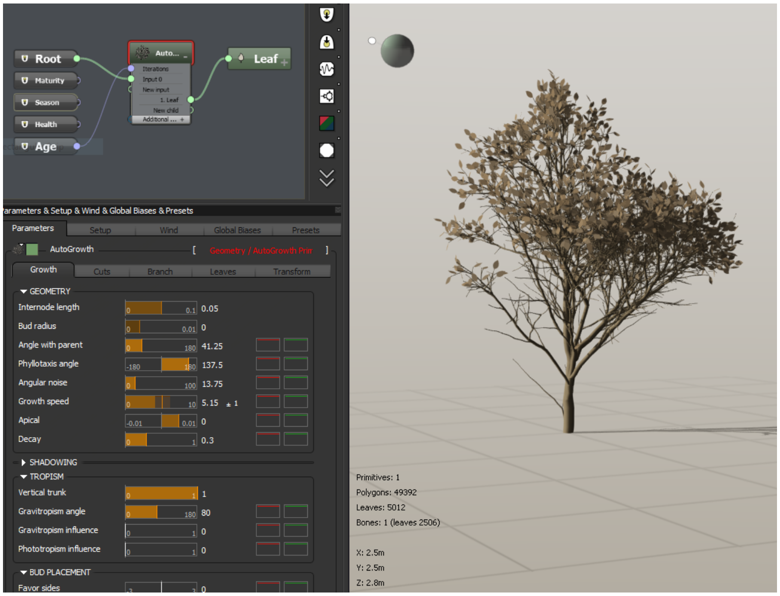
This parameter controls the strength of the Phototropism effect.

Range : 0 to 1.

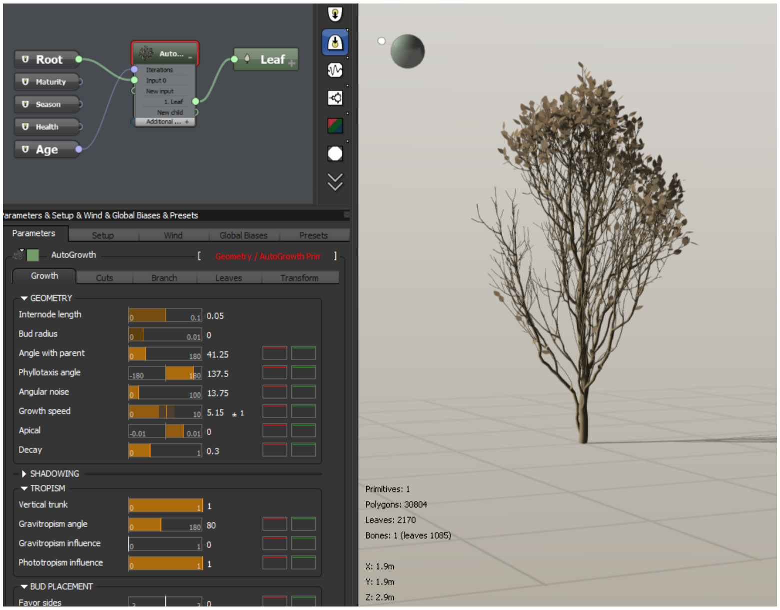
This parameter can be controlled by the age and parent filters.

It is evaluated once per growth iteration.

Phototropism Influence



No phototropism



Some phototropism

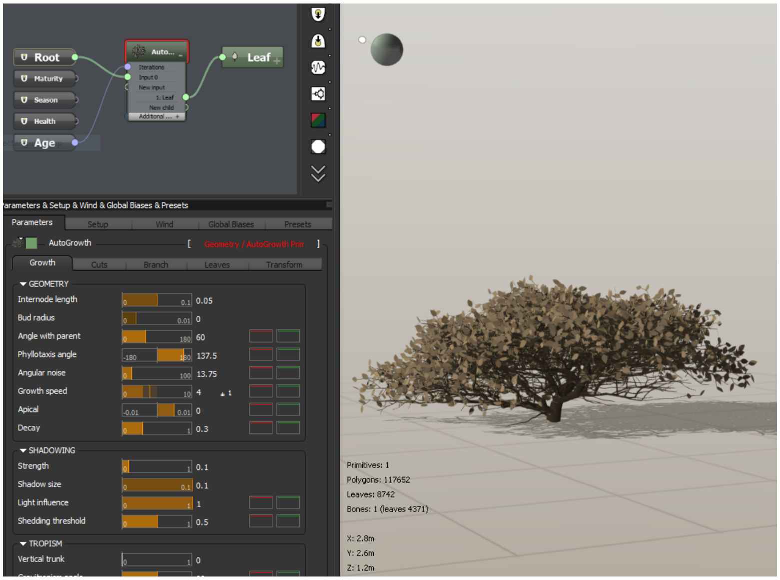
Vertical Trunk

This is an option to force full gravitropism to zero for the “trunk” branch, so that you can set a horizontal tropism for branches but still keep a vertical trunk to make pine like trees.

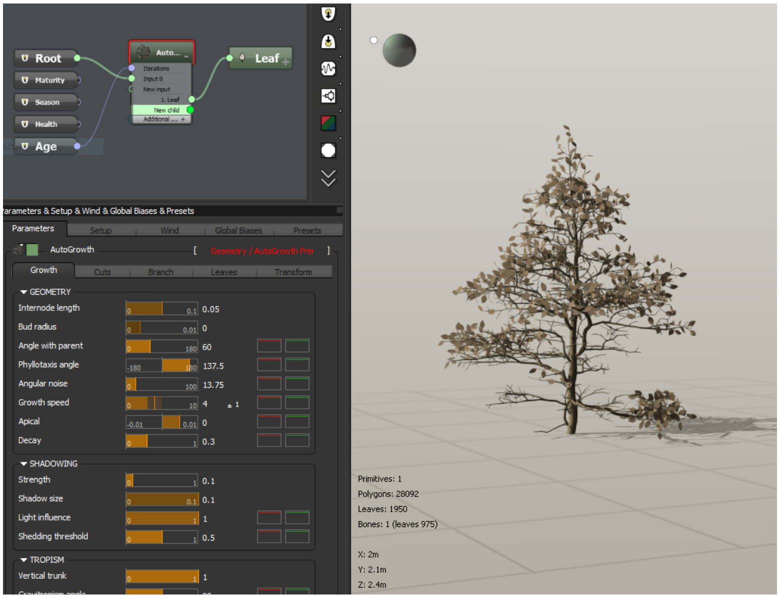
This is a constant for the growth node.

Note this needs to have non zero Gravitropism influence to have an effect. The trunk will be straighter with high gravitropism.

Vertical Trunk



Vertical Trunk Off



Vertical Trunk On

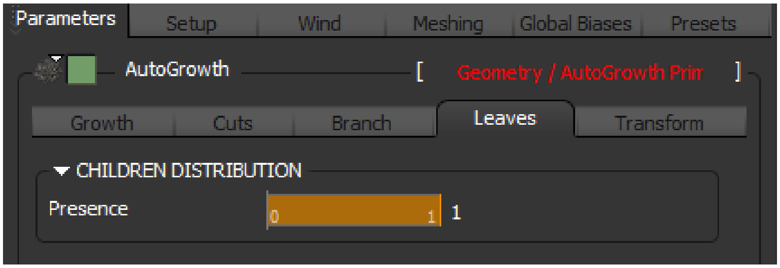
Tip

If you want **large curves** using the gravitropism, use a **small weight**, not a large one !

Leaves Tab

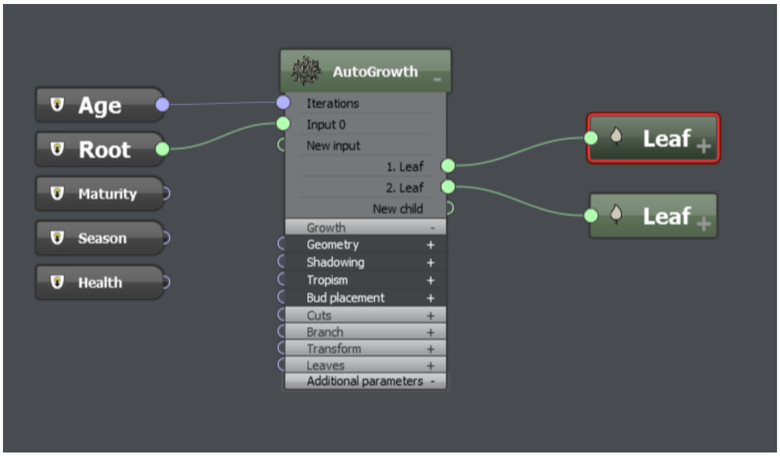
- Children Distribution

Children Distribution



Children Distribution parameters

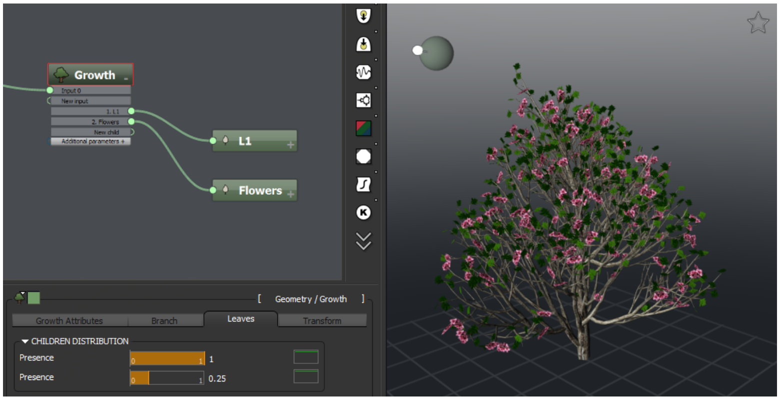
The growth node can be connected to multiple leaf nodes. This allows to mix different kind of leaves.



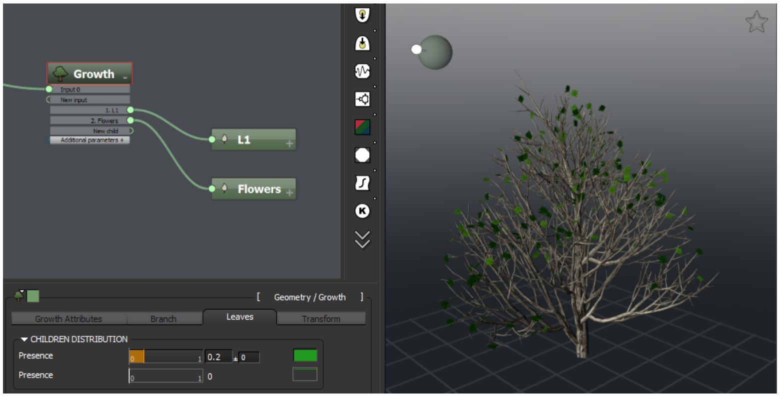
There is one weight (Presence) for each leaf node to control the distribution over the grown branches.

For instance, setting uniform weights will produce an equal distribution of each leaf over the tree.

As the leaves are created at the end of simulation, this parameter cannot be controlled with the age filter.



When the sum of the weights is **less than 1**, the remaining weight is attributed to "no leaf". That allows to reduce the foliage density.



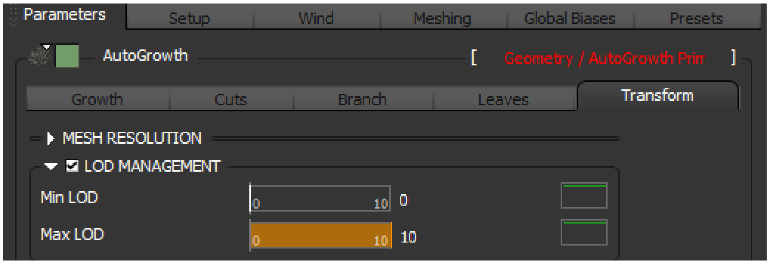
Transform Tab

- LOD Management Group
- Mesh Resolution Group

Studio, Producer…

…Studio, Producer

LOD Management Group

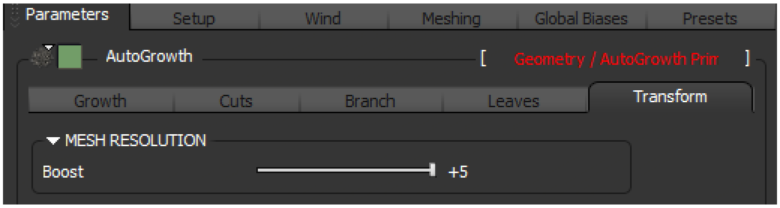


Mesh Resolution group

Min LOD and Max LOD

The AutoGrowth primitive is processed only when the current LOD is between the **Min LOD** and the **Max LOD**.

Mesh Resolution Group



Mesh Resolution group

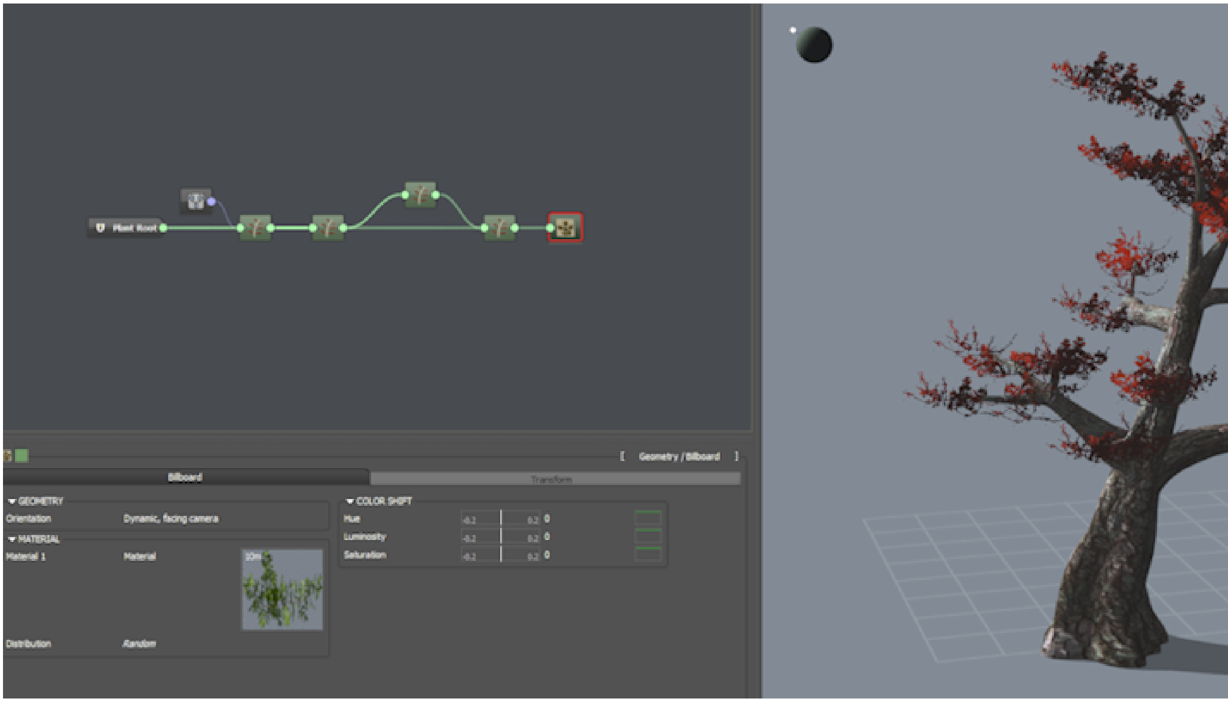
Boost

This parameter applies when the meshing mode is set to Automatic.

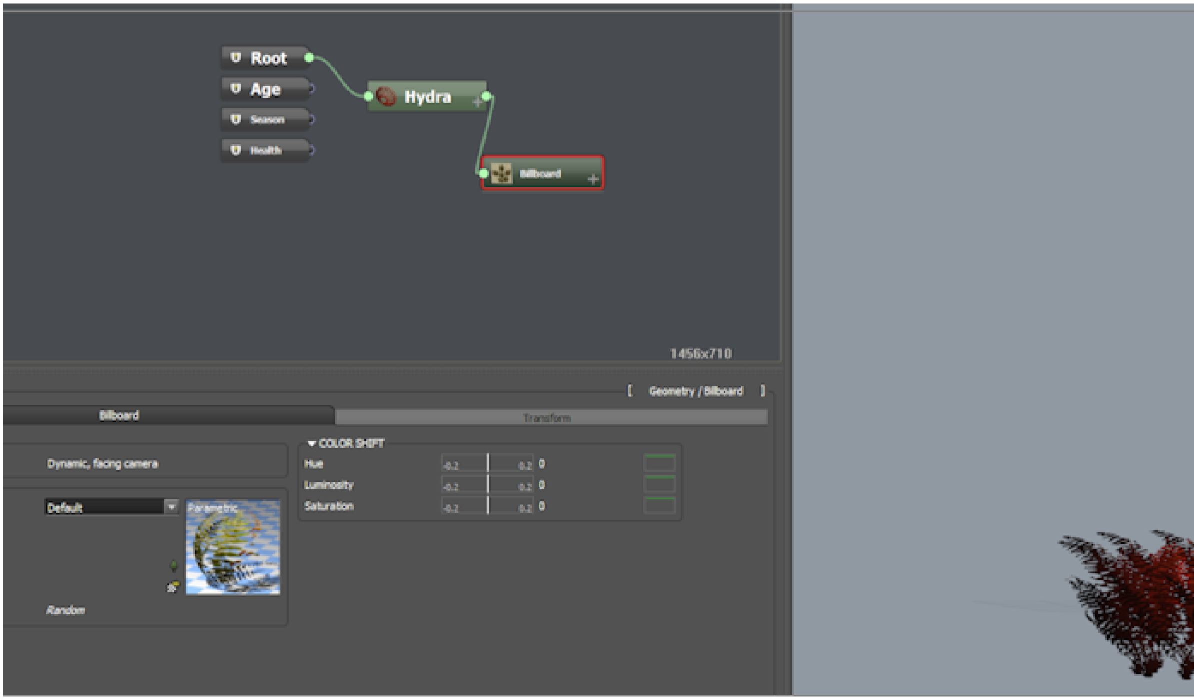
It increases/decreases the polygon density by a factor 2^boost

Leaf

A leaf creates a flat rectangular shape. It is very useful to represent leaves for trees when you need a plant with a lower pixel count.



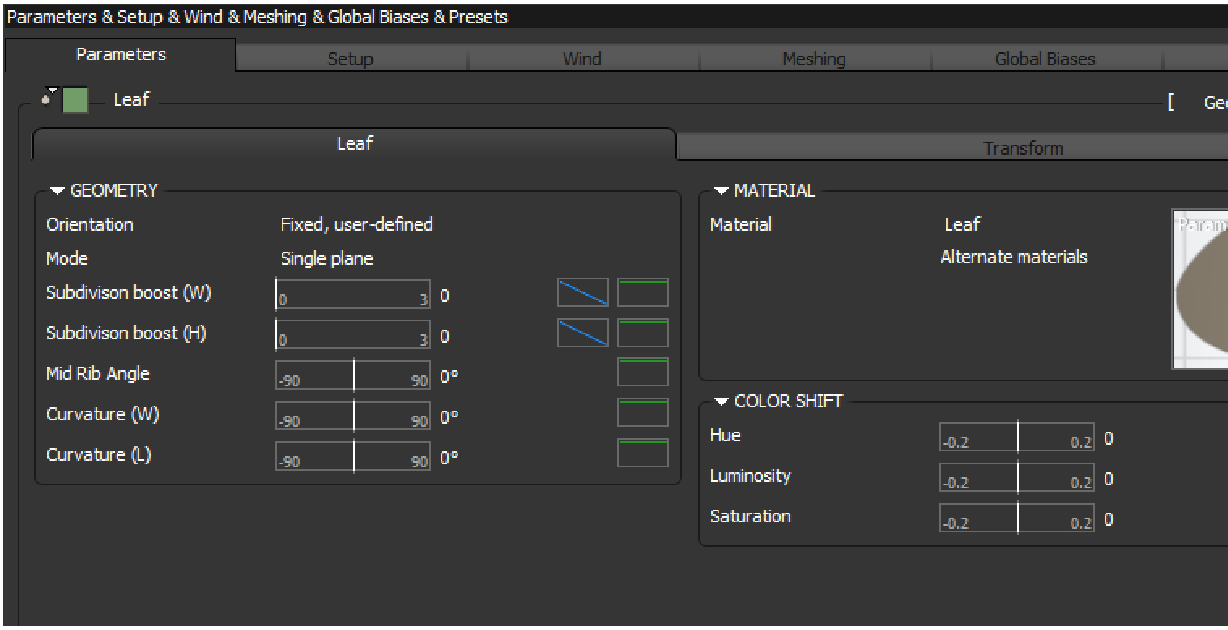
Leaves can be used to create bushes and plants by themselves.



There are two parameter tabs for the Leaf:

- **Leaf Tab:** This tab contains the Leaf main properties
- **Transform Tab:** These parameters globally modify the Leaf position and orientation with respect to the rest of the plant.

Leaf Tab



Some of the fields on this tab are range parameters. The value can be changed by moving the slider to the left or right. When the field is selected you will also see a "±" symbol and a field. Here you can enter a value for variance of the slider value. For more information about using this field, check the Random Range Parameter page.

A few fields on this tab have a filter available for the parent instance. For more information about the use of these filters, check the Filter Editor page.

Geometry

This tab defines the geometric properties of the Leaf.

The main setting is **Orientation**.

The first possible value **Fixed, user defined** is describe in the next paragraph. The other values are described later.

Fixed Orientation Leaves

In that mode, the leaf orientation depends only on the orientation parameters defined in its parent primitive instance.

The fixed orientation leaves can be composed of a variable number of polygons, contrary to other modes where the leaf is limited to a single quad.

A secondary mode controls what kind of mesh to use.

- **Single plane:** allows to use a grid based mesh.
- **Crossed planes:** allows to use 2 or 3 orthogonal quads.

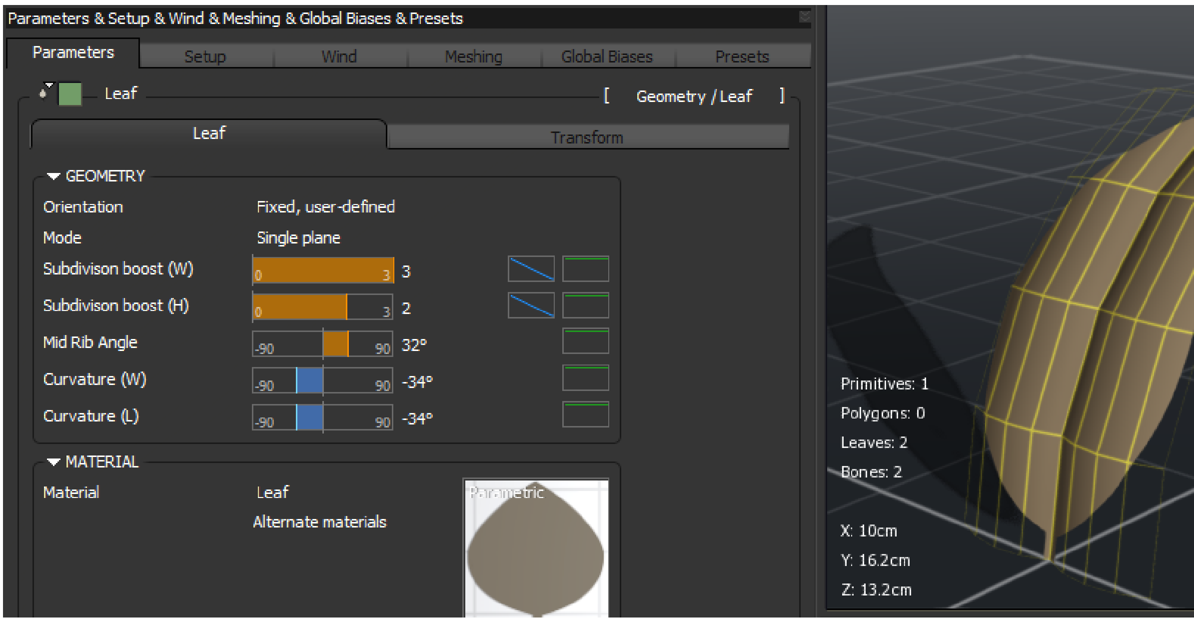
Single plane

Single plane leaves have a grid based mesh. It can be subdivided up to 8×8. We limited this setting to a small value as the goal of this leaf is just to be a bit more realistic than flat leaves, not to produce high-res versions. It must be also be light enough for a real time implementation involving lot of leaves.

The parameters you can set are:

- **Subdivision boost (W/H):** defines the number of lateral/axial subdivisions as **2 ^ n** (0 is 1 subdiv, 3 is 8)
- **Mid rib angle:** defines the angle of the mid-rib of the leaf, at 0, the leaf is flat.
- **Curvature (W/H):** defines the lateral/axial curvature of the leaf, at 90° it closes on itself.

The blue filter reduces the subdivision with the LOD value.

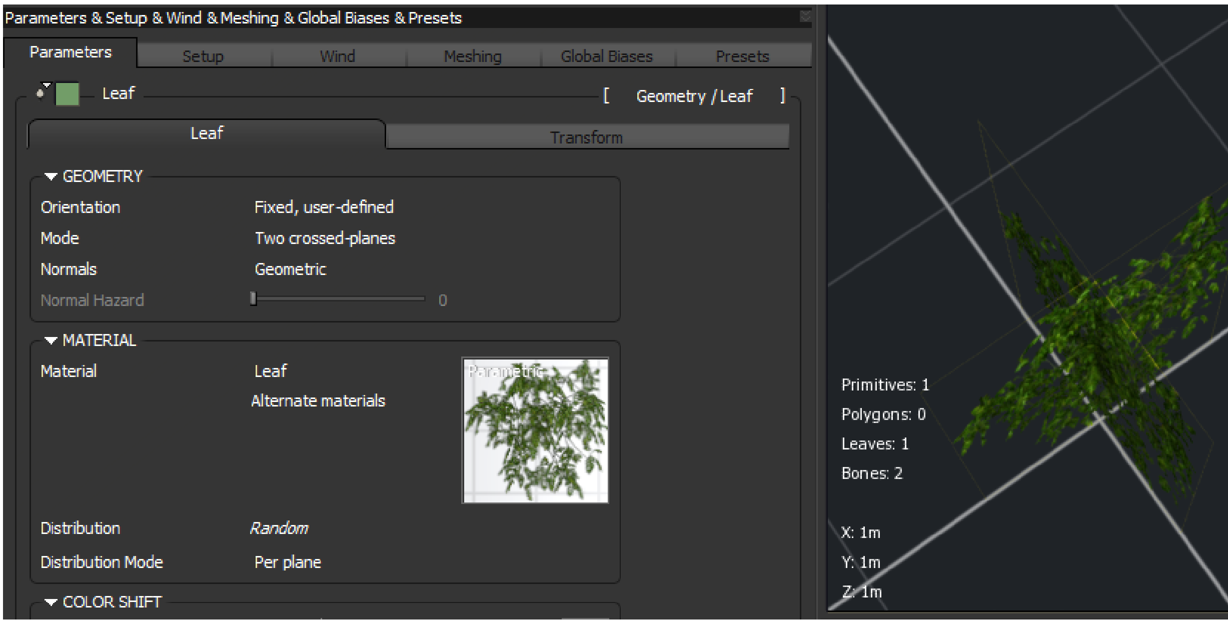


Two/Three crossed planes

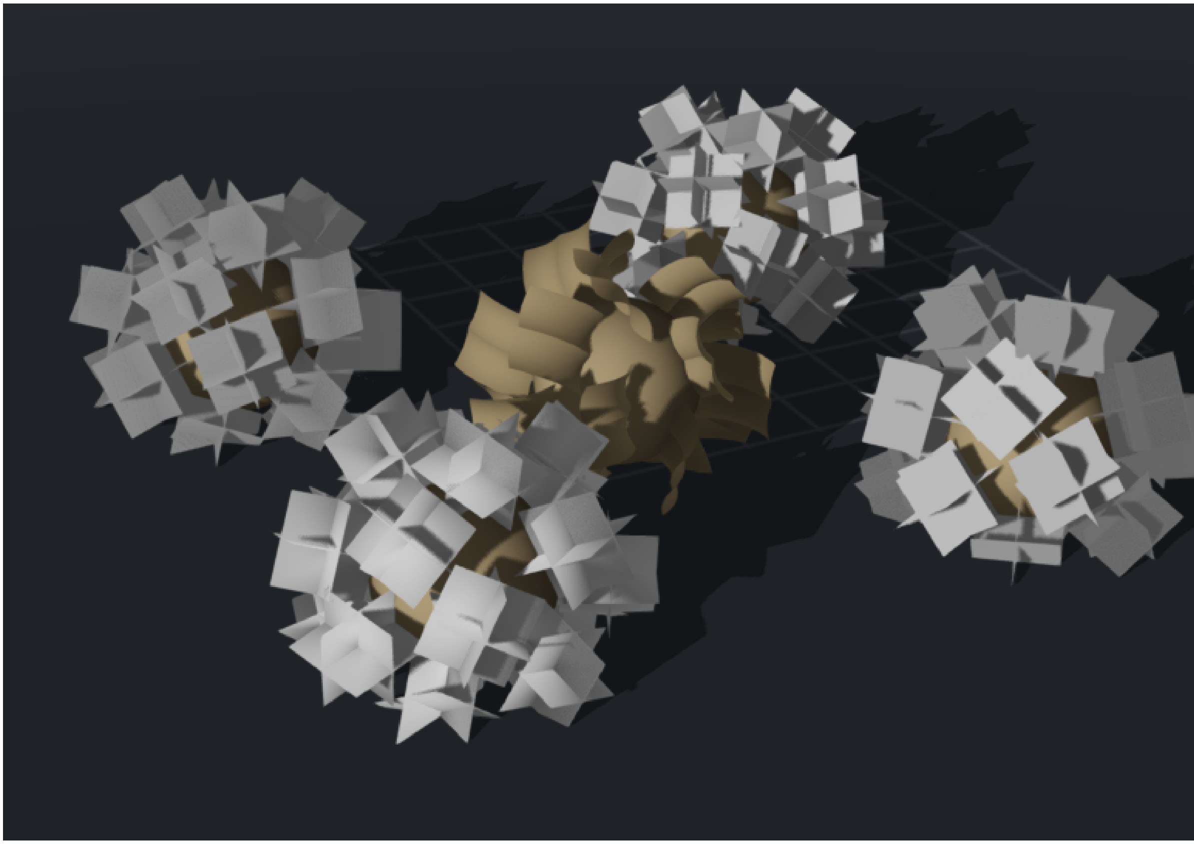
The crossed planes leaf is destined to be used as approximation of some complex geometry like some foliage or flower groups.

To soften the appearance of the crossed planes leaf, the **Normals** setting has been added to define how to compute the normals:

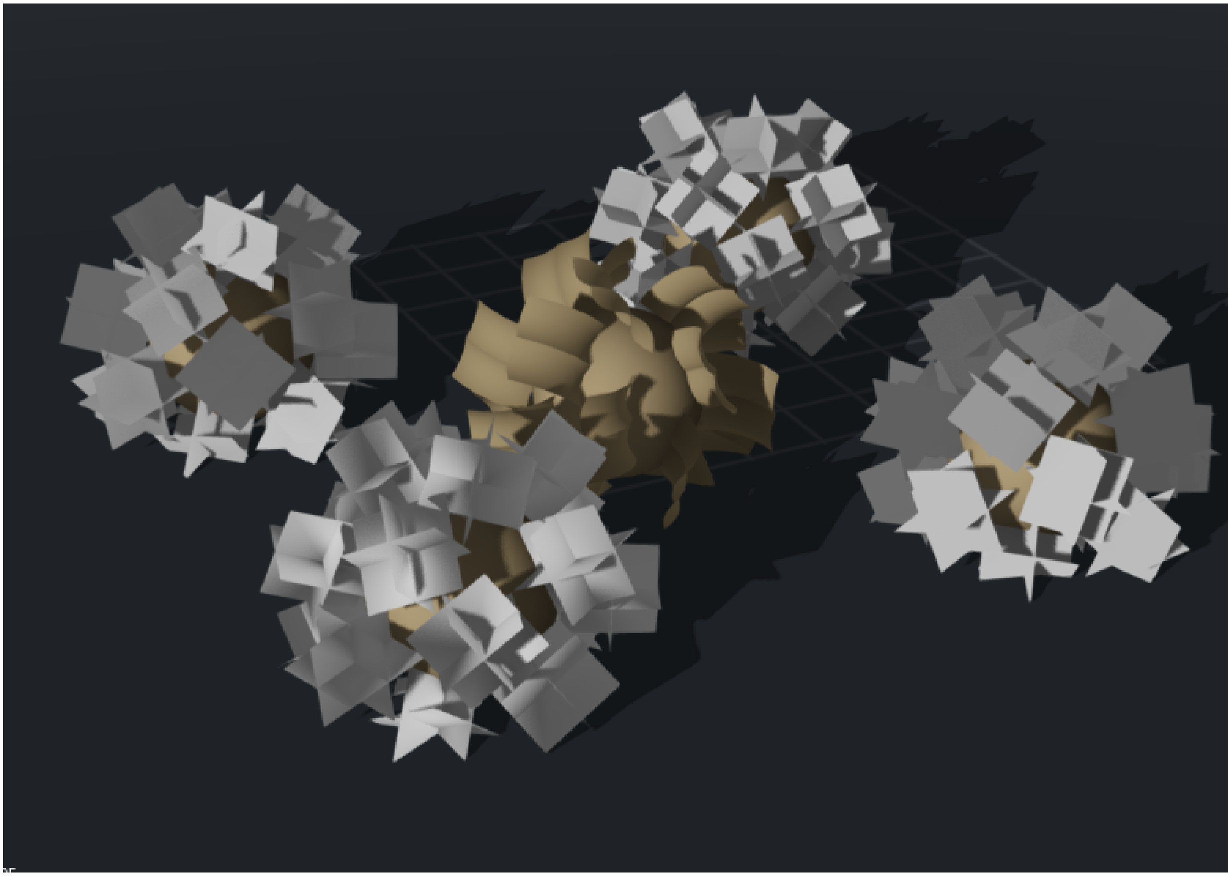
- **Geometric:** The normals are orthogonal to the surface of the crossed planes.
- **Leaf dir:** All the normals are the same for the crossed planes, using the leaf axis direction as value.
- **Plant sphere:** The normals are computed using the direction from the center of mass of all the leaves of the plant.
- **Local sphere:** The normals are computed using the direction from the origin of the leaf.



Here you can see the effect of the **Normals** setting on crosses planes, and detailed leaves in the middle.



Then the **normal hazard** setting adds a random rotation to the normals. It is destined to reduce the homogeneity of the lighting on nearby crossed-planes. See the previous image with maximum normal hazard:



Other orientation modes

The other possible values for the **Orientation** setting are:

- **Fixed, facing current camera:** the position of the current camera is used to bake the orientation of the leaf. Moving the camera won't alter the leaf orientation unless you recompute the plant.
- **Fixed, outwards:** the leaf is always parallel to the plant vertical axis.
- **Fixed, facing X axis:** the leaf always faces the X axis of the global coordinates system.
- **Dynamic, facing camera:** the leaf is oriented towards the current camera at preview and render. For export its orientation is overriden by the leaf orientation setting of the Export dialog.

Material group

This group defines the materials to use for the leaf.

Material

Defines material of this leaf (see Material parameter).

Distribution

Distribution of the materials of the leaf in case of multiple materials (see Distribution parameter).

Distribution mode

In the case of crossed-planes, this defines how to select the material for each plane.

- **Per plane:** the distribution of materials is allocated independently for each plane in each leaf.
- **Per billboard:** the distribution of materials is allocated per leaf : each plane uses the same material, but different leaves have randomized materials.
- **Per material groups:** triplets of materials are allocated to each leaf (using 2 or 3 planes does not matter). If you define 6 materials M1 to M6, some leaves will use M1/M2/M3 and others M4/M5/M6 for their 1st, 2nd and 3rd planes. Note the number of materials in the material list should be a multiple of 3.

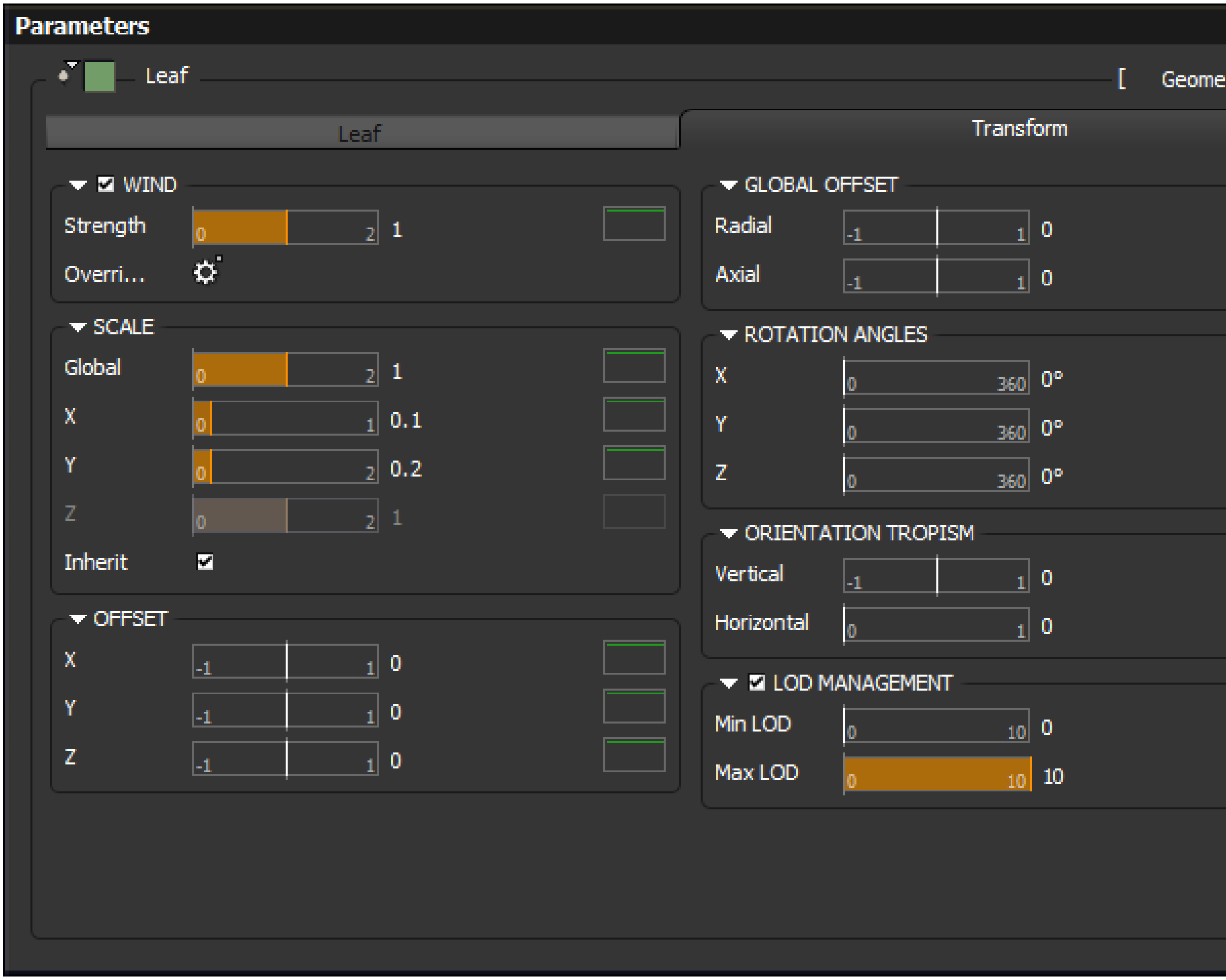
Color Shift

Parameters that shift the color of the leaf, easily varying the material.

- **Hue:** allows the shifting of hue values to change the leaf material color.
- **Luminosity:** allows the shifting of luminosity values to change the leaf material colors.
- **Saturation:** allows the shifting of saturation values to change the leaf material colors.

Leaf Transform Tab

These parameters globally modify the leaf position and orientation with respect to the rest of the plant.



Many of the fields on this tab are range parameters. The value can be changed by moving the slider to the left or right. When the field is selected you will also see a "±" symbol and a field. Here you can enter a value for variance of the slider value. For more information about using this field, check the Random Range Parameter page.

Most of the fields on this tab have a filter available for the parent instance. For more information about the use of these filters, check the Filter Editor page.

Wind

These parameters define some characteristics of the wind animation on the leaf.

- **Strength:** Node-specific multiplier to the amplitude of the wind animation.

- **Override breese response:** this can override global breeze settings on leaves (see Advanced Breeze Response Parameter)

Scale

Parameters to globally rescale the leaf along its local axes.

- **Global:** Globally scales the leaf in all directions.
- **X, Y, Z:** Globally scales the leaf in each of the directions of its local coordinates system.
- **Inherit:** Tells whether the leaf scale is impacted by its parent or not.

Offset

Parameters to globally offset the leaf along its local axes.

- **X, Y, Z:** Globally offsets the leaf by a translation along the local each X vector direction of its local coordinates system.

Global offset

These parameters define some characteristics of the wind animation on the leaf.

- **Axial:** Parameter that aligns the leaf along the global vertical axis.
- **Radial:** Parameter that aligns the leaf towards or away from the vertical axis at the center of the plant.

Rotation Angles

Parameters to globally rotate the leaf along its local axes.

- **X, Y, Z:** Globally rotates the leaf around its local axis by an angle in degrees.

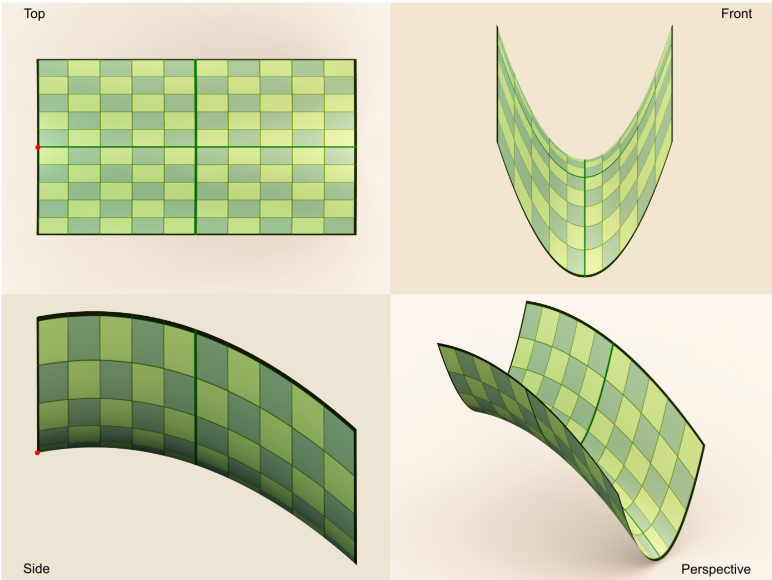
LOD Management

Studio, Producer

The leaf is visible only when the current LOD is between the **Min LOD** and the **Max LOD**

Warpboard

This shape was used in Vue's old plants. Despite the fact that similar results can be achieved with segment node blades, sometimes it may be useful to use warpboard as it has just a few parameters. It is thus easier to use and faster to define, especially when you need relatively simple shapes of leaves or petals. When you need more complex shapes and more control, use segment blades.



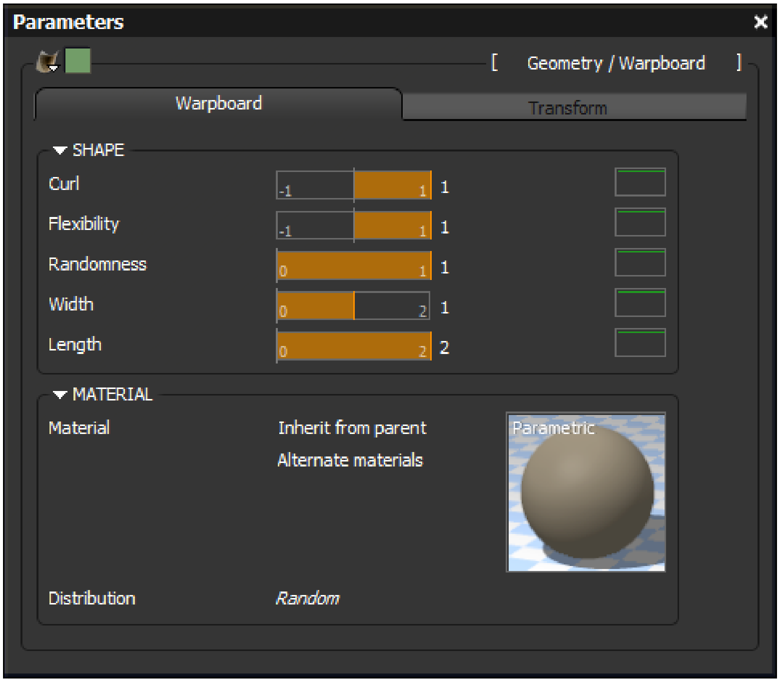
Warpboard

There are two tabs with parameters for the warpboard:

- **Warpboard Tab:** contains the geometric definitions for the warpboard.
- **Warpboard Transform Tab:** these parameters globally modify the billboard position and orientation with respect to the rest of the plant.

Warpboard Tab

Warpboard main properties.



Warpboard Tab

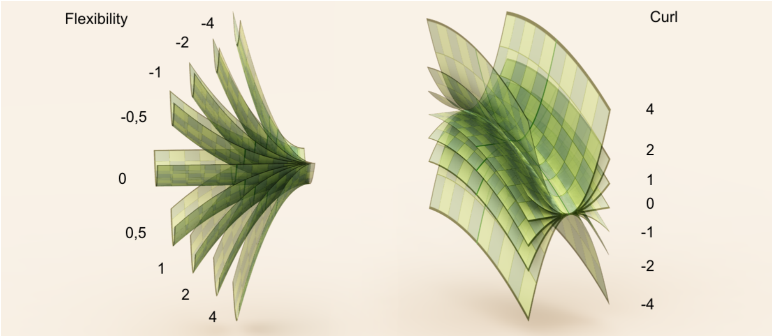
Many of the fields on this tab are range parameters. The value can be changed by moving the slider to the left or right. When the field is selected you will also see a "±" symbol and a field. Here you can enter a value for variance of the slider value. For more information about using this field, check the Random Range Parameter page.

Most of the fields on this tab have a filter available for the parent instance. For more information about the use of these filters, check the Filter Editor page.

Shape

These parameters describe the main geometrical properties of the warpboard.

- **Curl:** Lateral curvature of the warpboard.
- **Flexibility:** Longitudinal curvature of the warpboard.
- **Randomness:** Amount of randomization of the warpboard curl and flexibility values.
- **Width:** Width of the warpboard.
- **Length:** Length of the warpboard.



Flexibility, Curl

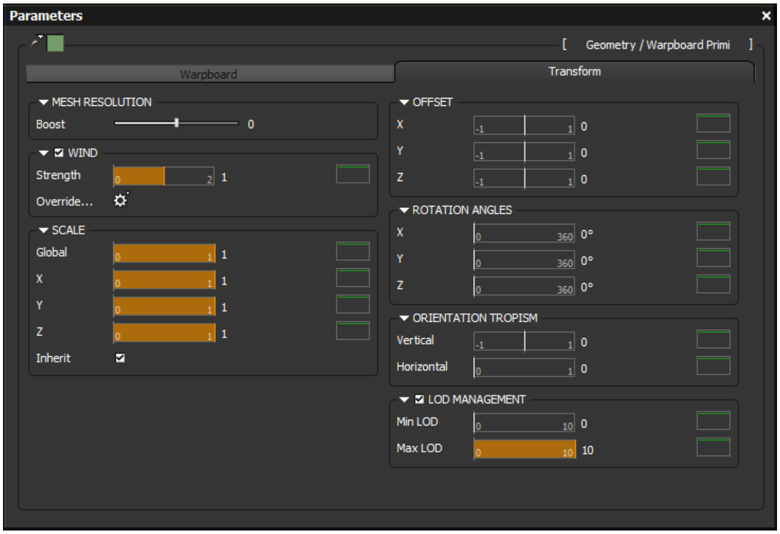
Material

This section defines the material for this warpboard.

- **Material:** defines the material for this warpboard (see Material parameter).
- **Distribution:** distribution of the materials of the warpboard in case of multiple materials (see Distribution parameter).

Warpboard Transform Tab

These parameters allow to globally modify the warpboard position and orientation with respect to the rest of the plant.



Transform Tab

Many of the fields on this tab are range parameters. The value can be changed by moving the slider to the left or right. When the field is selected you will also see a "±" symbol and a field. Here you can enter a value for variance of the slider value. For more information about using this field, check the Random Range Parameter page.

Most of the fields on this tab have a filter available for the parent instance. For more information about the use of these filters, check the Filter Editor page.

Mesh resolution

Parameters controlling the level of detail of the generated geometry.

- **Boost:** Controls the level of subdivision for this warpboard.

Wind

These parameters allow to define some characteristics of the wind animation on the warpboard.

- **Strength:** Node-specific multiplier to the amplitude of the wind animation.
- **Override breese response:** this can override global breeze settings on warpboards (see Advanced Breeze Response Parameter)

Scale

Parameters to globally rescale the warpboard along its local axes.

- **Global:** Globally scales the warpboard in all directions.
- **X, Y, Z:** Globally scales the warpboard in each of the directions of its local coordinates system.
- **Inherit:** Tells whether the warpboard scale is impacted by its parent or not.

Offset

Parameters to globally offset the warpboard along its local axes.

- **X, Y, Z:** Globally offsets the warpboard by a translation alone each of its vectors.

Rotation angles

Parameters to globally rotate the warpboard around its local axes.

- **X, Y, Z:** Globally rotates the warpboard around each of its local axes in degrees.

Orientation tropism

These parameters allow to turn the warpboard towards particular directions.

- **Vertical:** Parameter used to adjust the warpboard global orientation towards top or bottom.
- **Horizontal:** Parameter used to adjust the warpboard global orientation towards the nearest horizontal direction.

LOD Management

Studio, Producer

The segment is visible only when the current LOD is between the **Min LOD** and the **Max LOD**.

Object

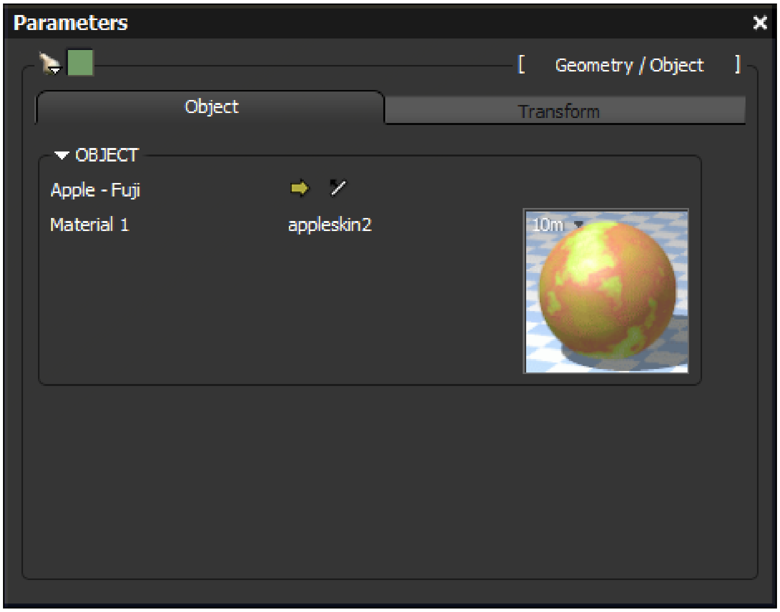
Includes the geometry of an external mesh-like object in the plant.

There are two tabs for object parameters:

- **Object Tab:** Main properties of the object node.
- **Object Transform Tab:** These parameters allow to globally modify the object position and orientation with respect to the rest of the plant.

Object Tab

This defines the object that should be replicated in the primitive instances issued from this node as well as its texture.

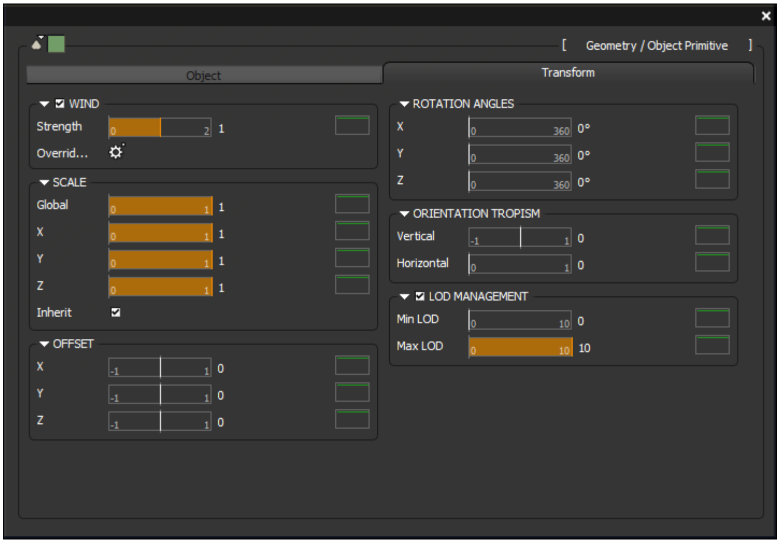


Object Tab

- **Object:** Select the object to be imported and its geometry integrated into the plant. Only objects that have been baked to polygons (meshes) can be imported. Click the arrow to open the **Object Browser** and select an object. When loaded, the name of the object displays along with its materials (see Material parameter). It is possible to define whether imported geometry is double sided.

Object Transform Tab

These parameters allow to globally modify the object position and orientation with respect to the rest of the plant.



Transform Tab

Many of the fields on this tab are range parameters. The value can be changed by moving the slider to the left or right. When the field is selected you will also see a "±" symbol and a field. Here you can enter a value for variance of the slider value. For more information about using this field, check the Random Range Parameter page.

Most of the fields on this tab have a filter available for the parent instance. For more information about the use of these filters, check the Filter Editor page.

Wind

These parameters allow to define some characteristics of the wind animation on the object.

- **Strength:** Node-specific multiplier to the amplitude of the wind animation.
- **Override breese response:** this can override global breeze settings on objects(see Advanced Breeze Response Parameter)

Scale

Parameters to globally rescale the object along its local axes.

- **Global:** Globally scales the object in all directions.
- **X, Y, Z:** Globally scales the object in each of the directions of its local coordinates system.

- **Inherit:** Tells whether the object scale is impacted by its parent or not.

Offset

Parameters to globally offset the object along its local axes.

- **X, Y, Z:** Globally offsets the object in each of the directions of its local coordinates system.

Rotation angles

Parameters to globally rotate the object around its local axes.

- **X, Y, Z:** Globally rotates the object in each of the directions of its local coordinates system.

Orientation tropism

These parameters allow to turn the object towards particular directions.

- **Vertical:** Parameter used to adjust the object global orientation towards top or bottom.
- **Horizontal:** Parameter used to adjust the object global orientation towards the nearest horizontal direction.

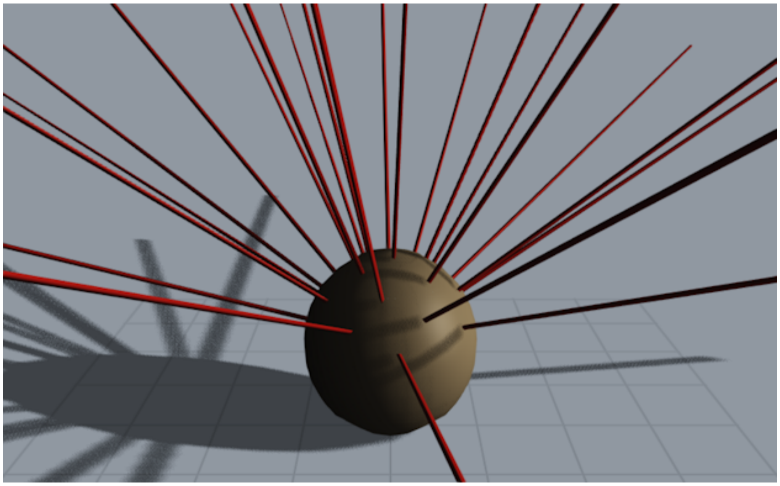
LOD Management

Studio, Producer

The segment is visible only when the current LOD is between the **Min LOD** and the **Max LOD**.

Urchin

The urchin generates spherical geometry and places child primitive instances around it. Most of the urchin parameters are for defining the children, not the urchin itself.



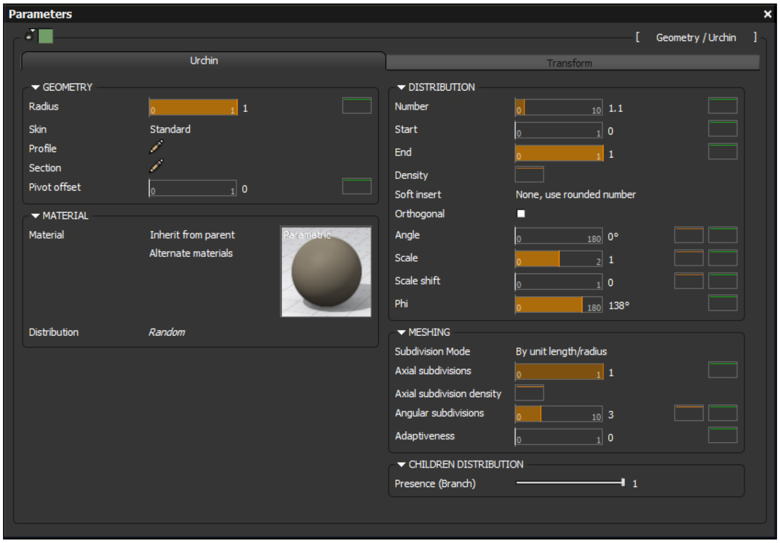
Urchin with Child Segments

The parameters for the urchin are divided into two tabs:

Urchin Tab

Urchin Transform Tab

Urchin Tab



Urchin Tab

Some of the fields on this tab are range parameters. The value can be changed by moving the slider to the left or right. When the field is selected you will also see a "±" symbol and a field. Here you can enter a value for variance of the slider value. For more information about using this field, check the Random Range Parameter page.

A few fields on this tab have a filter available for the parent instance. For more information about the use of these filters, check the Filter Editor page.

Geometry

These parameters describe the main geometrical properties of the urchin.

- **Radius:** Radius of the urchin.
- **Skin:** Tells whether the urchin should have an associated geometry (Standard) or not. If you select **None**, the geometry is invisible.
- **Profile:** Defines the z profile of the urchin. See the Profile spline parameter page for more details on the profile editor.
- **Section:** Defines the x-y profile of the urchin. See the Section spline parameter page for more details on the section editor.
- **Pivot offset:** Hooking point for the urchin.

Defines how the urchin center should be moved along its orientation axis with respect to its original position. These values have an especially remarkable action regarding the urchin point that coincides with the urchin primitive instance position :

- **0:** the urchin lowest point (south pole)
- **0.5:** the urchin center
- **1:** the urchin highest point (north pole)

Material

Material definition for this urchin.

- **Material:** defines the material for this urchin (see Material parameter).
- **Distribution:** distribution of the materials of the urchin in case of multiple materials (see Distribution parameter).

Distribution

Parameters describing the children distribution and arrangement for the urchin.

- **Number:** Amount of child primitive instances.
- **Start:** Position on urchin from where the child primitive instance spreading starts. 0 means urchin bottom ; 1 means urchin top.
- **End:** Position on urchin from where the child primitive instance spreading ends. 0 means urchin bottom ; 1 means urchin top.
- **Density:** Density function of the child primitive instances on the urchin (see Filter parameter).
- **Soft insert:** Controls the children distribution behavior in case the child instances number has a fractional part.
  - **None, use rounded number:** the child instances number is rounded to the nearest integer.
  - **None, use rounded up number:** the child instances number is rounded up to the next higher integer.
  - **Scale down fractional part:** an extra child instance is generated and its dimensions (length, radius, scale...) are scaled down according to the fractional part of the child instances number.
  - **Random:** an extra child instance is generated randomly according to the fractional part of the child instances number.
- **Orthogonal:** If enabled, the child orientation axis becomes orthogonal to the urchin surface.

- **Angle:** Angle of the rotation applied on child primitive instances tangential to the urchin. Disabled if **Orthogonal** is enabled.
- **Scale:** Scale factor applied on each child primitive instance.
- **Scale shift:** Makes instances scale influence distribution (small instances are closer than big instances). Only useful if scale is different between instances.
- **Phi:** Angle in degrees between two next instances.

Meshing

These parameters are used for manual subdivision

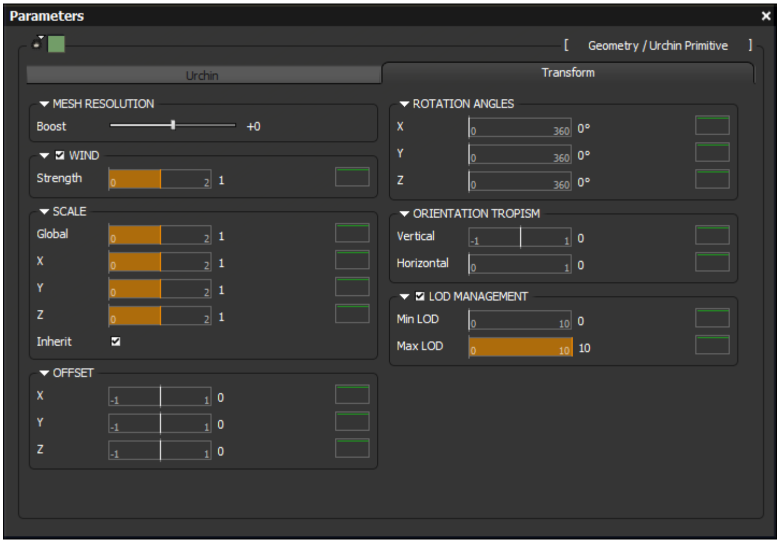
- **Axial subdivisions:** defines the number of subdivisions along the segment.
- **Axial subdivision density:** defines the distribution of the axial subdivisions along the segment.
- **Angular subdivisions:** defines the number of subdivisions around the segment.
- **Intelligence amount:** defines if subdivisions distribution is done automatically or using density parameter.

Children distribution

If children have been defined, this section displays. These are parameters that describe the children distribution and arrangement.

- **Presence:** Defines different generation probabilities for the various output connections of the urchin.

Urchin Transform Tab



Transform Tab

Many of the fields on this tab are range parameters. The value can be changed by moving the slider to the left or right. When the field is selected you will also see a "±" symbol and a field. Here you can enter a value for variance of the slider value. For more information about using this field, check the Random Range Parameter page.

Most of the fields on this tab have a filter available for the parent instance. For more information about the use of these filters, check the Filter Editor page.

Mesh Resolution

This controls the level of detail of the generated geometry and its skinning.

- **Boost:** Set to increase the quality of mesh resolution

Wind

- **Strength:** Node-specific multiplier to the amplitude of the wind animation.

Scale

- **Global:** Globally scales the urchin in all directions.

- **X, Y, Z:** Globally scales the urchin in each of the directions of its local coordinate system.
- **Inherit:** Tells whether the urchin scale is impacted by its parent or not.

Offset

- **X, Y, Z:** Offsets the urchin by a translation along the different local vectors.

Rotation Angles

- **X, Y, Z:** Globally rotates the urchin around its local axis by an angle in degrees.

Orientation Tropism

These parameters turn the urchin towards particular directions.

- **Vertical:** Used to adjust the urchin global orientation towards top or bottom.
- **Horizontal:** Used to adjust the urchin global orientation towards the nearest horizontal direction.

LOD Management

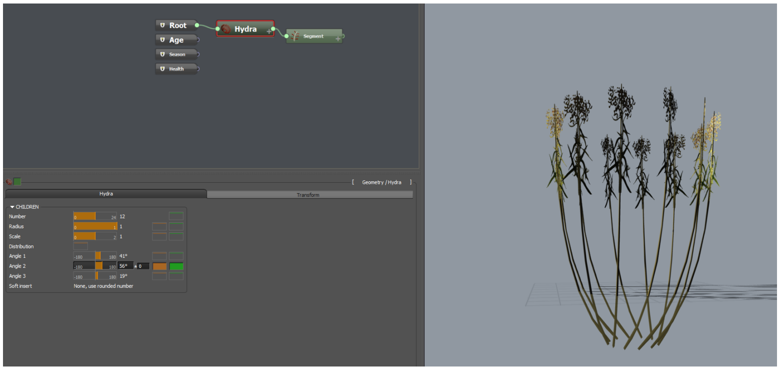
Studio, Producer

The segment is visible only when the current LOD is between the **Min LOD** and the **Max LOD**.

Hydra

The hydra does not generate its own geometry but it is possible to connect any number of child nodes to the hydra which spread out around a circle.

One of the many things hydras can be used to create are plants that grow in clumps, like weeds.

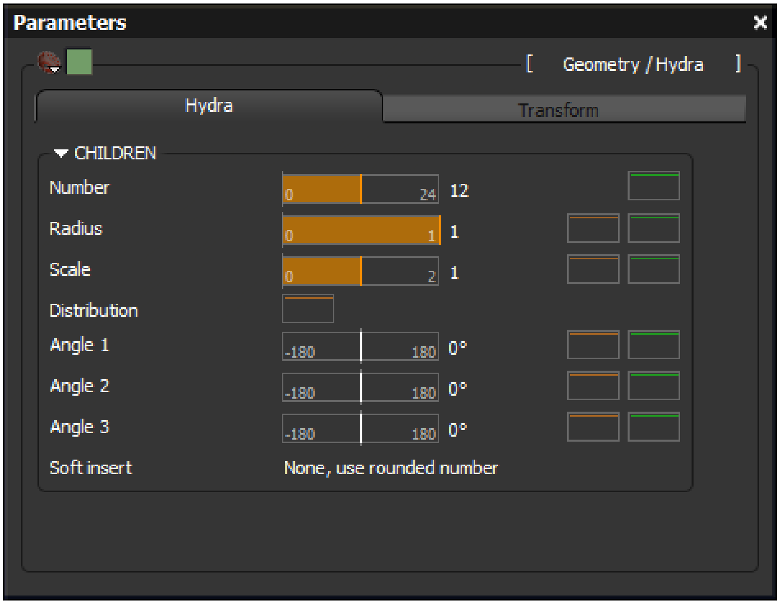


Hydra Weeds

There are two tabs of parameters for the hydra:

- **Hydra Tab**: this tab contains the parameters for the children of the hydra geometry.
- **Hydra Transform Tab**: these parameters globally modify the hydra position and orientation with respect to the rest of the plant.

Hydra Tab



Hydra Tab

Many of the fields on this tab are range parameters. The value can be changed by moving the slider to the left or right. When the field is selected you will also see a "±" symbol and a field. Here you can enter a value for variance of the slider value. For more information about using this field, check the Random Range Parameter page.

Most of the fields on this tab have two filters available. One for the current instance and one for the parent instance. For more information about the use of these filters, check the Filter Editor page.

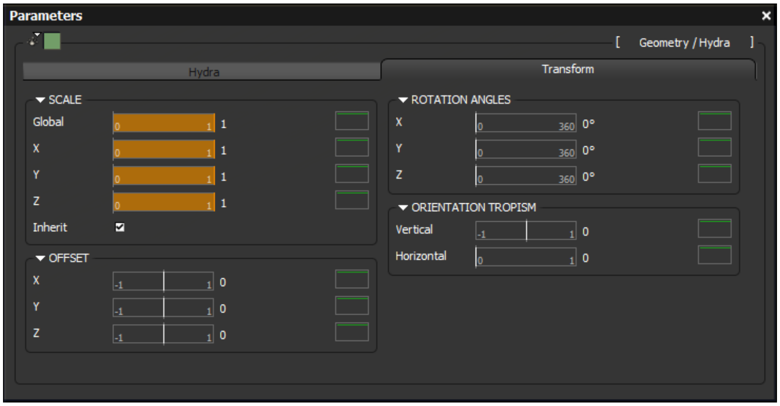
Children

These parameters describe the children distribution and arrangement for the hydra.

- **Number:** Number of child primitive instances.
- **Radius:** Radius of the hydra circle.
- **Scale:** Scale factor applied on each child primitive instance.
- **Distribution:** Distribution function of the child instances around the hydra circle. Controlled by a filter.
- **Angle 1:** Angle of the rotation applied to the instances that are orthogonal to the hydra circle plane.
- **Angle 2:** Angle of the rotation applied to the instances that are tangential to the hydra circle plane.
- **Angle 3:** Angle of the rotation applied to the instances that are around the hydra axis.
- **Soft insert:** Controls the children distribution behavior in case the child instances number has a fractional part.
  - **None, use rounded number:** the child instances number is rounded to the nearest interger.
  - **Scale down fractional part:** an extra child instance is generated and its dimensions (length, radius, scale...) are scaled down according to the fractional part of the child instances number.
  - **Random:** an extra child instance is generated randomly according to the fractional part of the child instances number.

Hydra Transform Tab

These parameters globally modify the hydra position and orientation with respect to the rest of the plant.



Transform Tab

Many of the fields on this tab are range parameters. The value can be changed by moving the slider to the left or right. When the field is selected you will also see a "±" symbol and a field. Here you can enter a value for variance of the slider value. For more information about using this field, check the Random Range Parameter page.

Most of the fields on this tab have a filter available for the parent instance. For more information about the use of these filters, check the Filter Editor page.

Scale

Parameters to globally rescale the hydra along its local axes.

- **Global:** Globally scales the hydra in all directions.
- **X, Y, Z:** Globally scales the hydra in each of the directions of its local coordinates system.
- **Inherit:** Tells whether the hydra scale is impacted by its parent or not.

Offset

Parameters to globally offset the hydra along its local axes.

- **X, Y, Z:** Globally offsets the hydra along each of its local axes.

Rotation angles

Parameters to globally rotate the hydra around its local axes.

- **X, Y, Z:** Globally rotates the hydra in around each of its local axes.

Orientation tropism

These parameters turn the hydra towards particular directions.

- **Vertical:** Parameter used to adjust the hydra global orientation towards top or bottom.
- **Horizontal:** Parameter used to adjust the hydra global orientation towards the nearest horizontal direction.

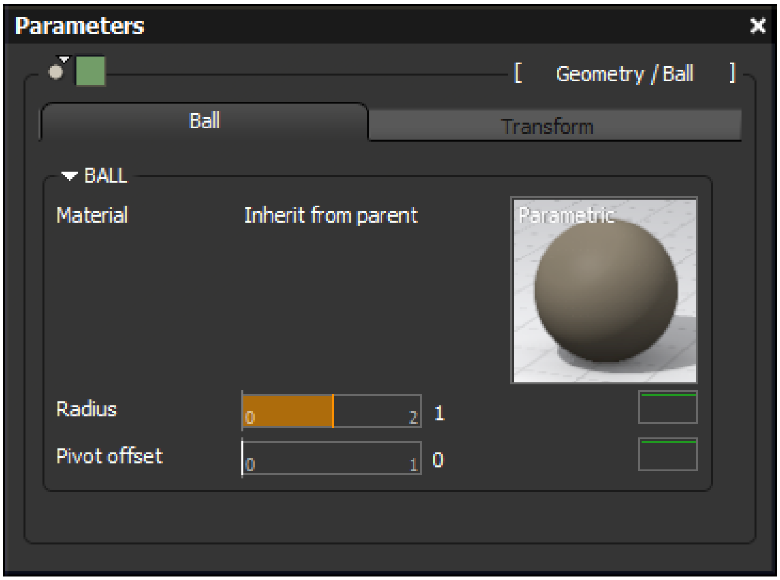
Ball

A ball creates a round, circular geometry. It can be used for fruits on trees and bushes.

There are two parameter tabs for the ball:

- **Ball Tab:** This tab contains the material attribute for the ball.
- **Ball Transform Tab:** These parameters globally modify the ball position and orientation with respect to the rest of the plant.

Ball Tab



Ball Tab

Two of the fields on this tab are range parameters. The value can be changed by moving the slider to the left or right. When the field is selected you will also see a "±" symbol and a field. Here you can enter a value for variance of the slider value. For more information about using this field, check the Random Range Parameter page.

Most of the fields on this tab have a filter available for the parent instance. For more information about the use of these filters, check the Filter Editor page.

Ball

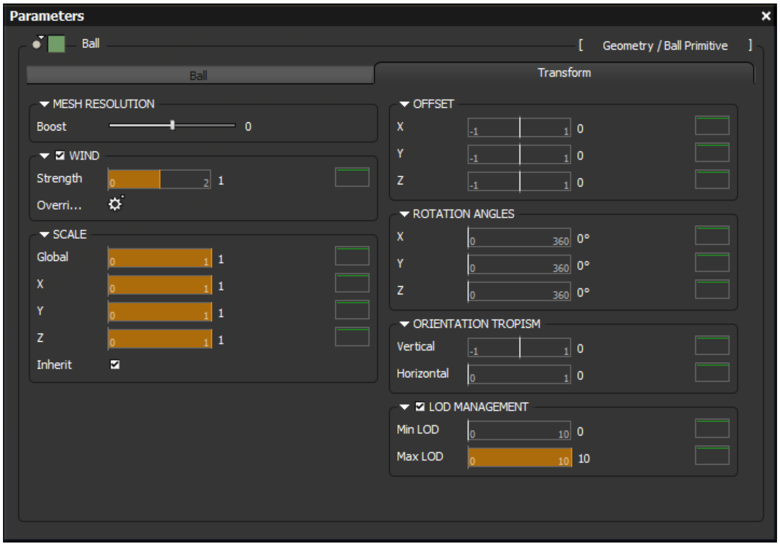
The following are the parameters for the ball geometry.

- **Material:** defines the material for the ball (see Material parameter).
- **Radius:** Radius of the ball.
- **Pivot offset:** Hooking point for the ball. It defines how the ball center should be moved along its orientation axis with respect to its original position. These values have an especially remarkable action regarding the ball point that coincides with the ball primitive instance position :

  - **0:** the ball lowest point (south pole)
  - **0.5:** the ball center
  - **1:** the ball highest point (north pole)

Ball Transform Tab

These parameters allow for global modification of the ball position and orientation with respect to the rest of the plant.



Transform Tab

Many of the fields on this tab are range parameters. The value can be changed by moving the slider to the left or right. When the field is selected you will also see a “±” symbol and a field. Here you can enter a value for variance of the slider value. For more information about using this field, check the Random Range Parameter page.

Most of the fields on this tab have a filter available for the parent instance. For more information about the use of these filters, check the Filter Editor page.

Mesh resolution

Parameters controlling the level of detail of the generated geometry.

- **Boost:** Controls the level of subdivision for this ball.

Wind

These parameters are used to define some characteristics of the wind animation on the ball.

- **Strength:** Node-specific multiplier to the amplitude of the wind animation.

Scale

Parameters to globally rescale the ball along its local axes.

- **Global:** Globally scales the ball in all directions.

- **X, Y, Z:** Globally scales the ball in each of the directions of its local coordinates system.
- **Inherit:** Tells whether the ball scale is impacted by its parent or not.

Offset

Parameters to globally offset the ball along its local axes.

- **X, Y, Z:** Globally offsets the ball in each of the directions of its local coordinates system.

Rotation angles

Parameters to globally rotate the ball around its local axes.

- **X, Y, Z:** Globally rotates the ball in each of the directions of its local coordinates system.

Orientation tropism

These parameters allow to turn the ball towards particular directions.

- **Vertical:** Parameter used to adjust the ball global orientation towards top or bottom.
- **Horizontal:** Parameter used to adjust the ball global orientation towards the nearest horizontal direction.

LOD Management

Studio, Producer

The segment is visible only when the current LOD is between the **Min LOD** and the **Max LOD**.

Parameter Extensions

On the Parameters Tabs, many of the parameters have the same fields that serve as extensions or modifiers of the parameters themselves. Three of the most common in geometry nodes are:

- Random Range Parameter
- Filter Parameter
- Material Parameter

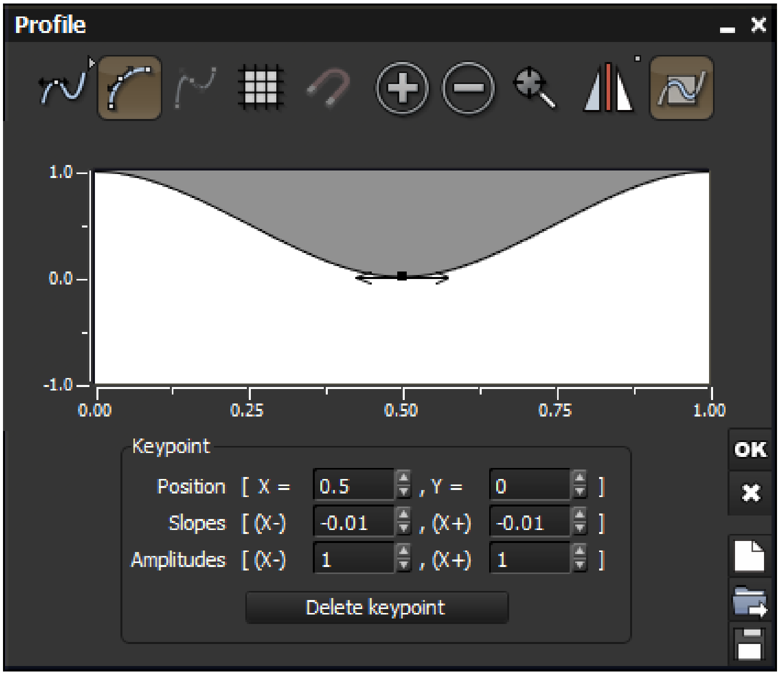
Filter parameter

Filter Parameter

Filter parameters only contain one filter, whose color depends on its input data type (Primal, Section angle, Radial or Other). These colors may be configured in the Interface colors dialog.

- **Left-clicking on the filter miniature:** allows to **edit** the filter using a Filter Editor.
- **Right-clicking on the filter miniature:** displays a pop-up menu :
  - **Edit Filter:** also opens a Filter Editor, same as left-clicking.
  - **Copy Filter:** copies the current filter in the clipboard. It can then be pasted in any other filter.
  - **Paste Filter:** replaces the current filter by the one in the clipboard, if any.
  - **Reset Filter:** replaces the current filter by a default one.
  - **Load Filter:** opens a filter Browser that allows to replace the current filter by another one from disk.
  - **Save Filter:** saves the current filter to disk.
  - **Help:** opens this page.

Filter Editor



Filter Editor

Description

Filters enable you to transform any number in the range of -1 to 1 into another number, also in the range of -1 to 1, following a curve that you define. The value returned by the filter at a given position on the horizontal ruler can be read on the vertical ruler of the curve.

The Filter Editor is accessed by clicking on the icon available for many fields in the geometry parameters section. There can be a filter for the primitive instance Profile or a filter for the function of parent.

Inside the Filter Editor, you can zoom in and out, and pan the view using standard commands (Right mouse drag to pan, Ctrl + Right mouse drag to zoom). You can also resize this Editor if you need a more detailed view of the filter.

The Curve

The curve is the large display that sits in the middle of the editor, just below the toolbar. This area represents the profile of the filter. You can zoom in and out, and pan the view using standard commands (Right mouse drag to pan, Ctrl + Right mouse drag to zoom).

Filters are built from **Key Points**, joined together by straight lines or curves. You can modify a filter by adding, moving or deleting key points. The key points are figured by small handles ( ) on the curve. These handles appear as soon as the mouse cursor is placed above the curve. All filters start from (0,0) and have a key point on the right edge (the corresponding handle can only be moved vertically).

Smooth Filters

There are three types of filters: hard curve, smooth curve and bezier curve.

Hard curve filters are generated from segments while smooth filters are generated from cubic curves.

You can switch to each type of filter, by clicking the first icon the the toolbar.

The behavior of a smooth filter is identical to that of a hard curve filter except that you can change the slope of the curve around the key points, yielding a smoother -round-profile.

To modify the slope around a key point, select the key point by clicking on its handle ( ), or by typing its horizontal position in the **Position X** box. The **Slope** boxes now indicate the slope to the left and to the right of the key point. Type in new slope values. If you selected the handle by clicking on it, the tangents to the curve. You can drag the ends of the tangents to modify the slope.

Selecting **Smooth joint** icon will ensure that the slope is the same on either side of the key point (the default). If you want to have a different slope on either side of the key point (e.g. to create a crease in the curve), you must deselect this option and then modify the slope.

Toolbar

The Filter Editor's toolbar is the collection of icons at the top of the editor. The meaning of these icons is as follows:

- **Smooth curve:** this is a multiple icon, between smooth curve, hard curve and bezier curve. Right-click on the icon to change the type of filter.
- **Auto-tangents:** this is also a toggle icon; it is only available when the filter is smooth. If the icon is toggled, the tangents at newly added key points will be

computed automatically in order to modify as little as possible the overall shape of the curve. If you drag a key point when this mode is active, the tangents will be modified dynamically so as to minimize the deformation of the curve.

- **Smooth joint:** this is also a toggle icon; it is only available when the filter is smooth and a key point is selected. If the icon is toggled, the slope on either side of the key point will be the same, ensuring that the resulting curve doesn't exhibit any sudden changes in slope around that key point. If you deselect this option, the slope on either side of the key point can be modified independently, resulting in a crease in the curve.
- **Show grid:** this is a toggle icon. When it is orange (enabled) a grid will be displayed on top of the curve. This grid can be used for reference when building a filter.
- **Snap to grid:** this is a toggle icon, available only when the grid is displayed. When snapping is on (the icon is orange), key points will be automatically "attracted" to the grid when you approach the mouse cursor from the grid. This is useful for setting up filters with "rounded" values.
- **Zoom in:** click this icon to display a zoomed view of the filter. This lets you edit detailed portions of the filter.
- **Zoom out:** click this icon to zoom out of the view of the filter. This lets you visualize a larger portion of the filter.
- **Reset pan/zoom:** click this icon to reset the view of the filter so that the filter fills up the entire graph exactly.
- **Flip Vertical Axis/Flip Horizontal Axis:** this flips the axis of the graph either horizontally or vertically.

New, Load, Save

Pressing **New** will reset the filter by deleting all key points.

Press **Load** to load one of the sample filters using the Visual Filter Browser.

Press **Save** to save the current filter in a stand-alone file, for use in future scenes. Saved filters will appear in the Visual Filter Browser like any other of the predefined filters. By default, filters are placed in the Filters subfolder. This means that they will appear in the Personal collection inside the Visual Filter Browser.

Show filter on defined domain only: Check this field if you want to actually see the clamping effect of the filter. As you scroll, the clamping becomes evident.

When checked, the filter curve will only be displayed in the range (x and y) where the filter is defined. For example when editing a bump filter (in the Material Editor), x is only defined within [-1, 1] and same for y. So when the box is checked, and the user uses the right mouse button to "scroll" the curve, the curve will not be displayed outside this range. It's like a clipping rectangle.

You can scroll by pressing the right mouse button on the picture and moving the mouse (with the right mouse button pressed). So if you check the checkbox, and scroll to the right (for example), eventually the curve will be clipped. The definition domain depends on the use of the filter.

Adding Key Points

To create a new key point, you can either:

- double-click in the area where the curve is drawn. The new key point is created at the point you clicked. The curve is redrawn to use the new key point.
- click on the curve where you want the new key point; the coordinates of the clicked point appear in the **Position** boxes; you can edit them if required. To create the new key point, press the **Add key point** button. The curve is redrawn.
- type the coordinates of the new key point in the **Position** boxes, then press the **Add key point** button. The curve is redrawn.
- the **Slopes** and **Amplitudes** settings are also available for modifications.

You can't create two key points at the same horizontal position.

Function of Parent

The Function of Parent filter has two additional **Parent Dependency** fields for modifications:

- **Parent level:** indicate the level of parent
- **Cascade:** indicate if there is a cascading effect.

Modifying Key Points

To modify a key point, you can either:

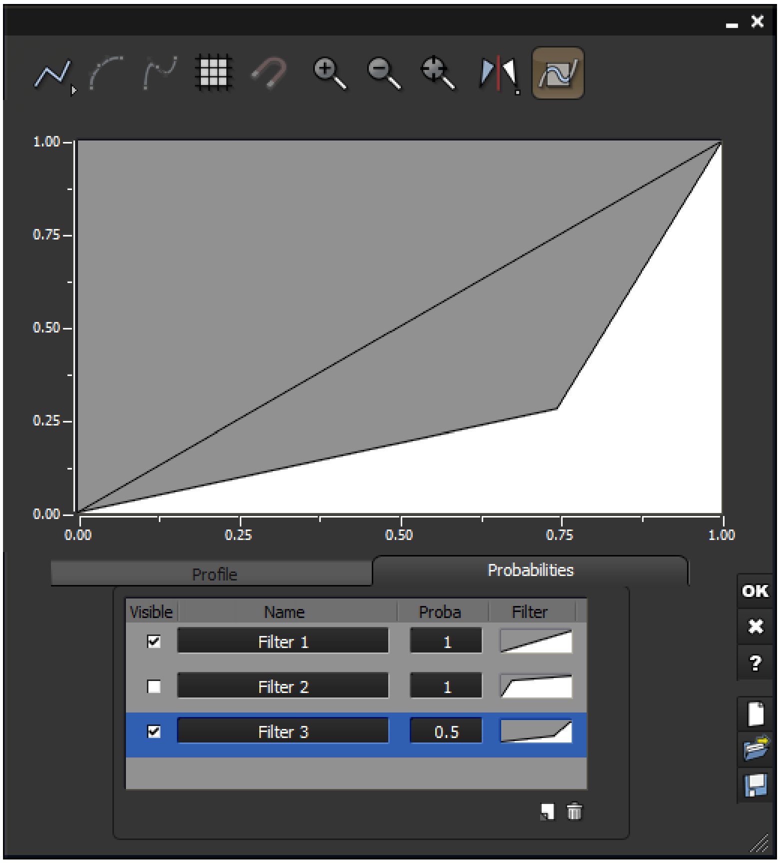
- click on the key point's handle and drag it with the mouse button pressed. If you press Control as you drag the cursor, the movement will be constrained to the closest axis. Each key point must stay between the previous one and the next one. When you select a key point, you can jump to the next one by pressing Tab (Shift Tab jumps to the previous). The selected key point becomes black. You can also modify the position of the key point by using the Up/Down and Left/Right arrow keys.
- click the handle of the key point you want to modify. The handle becomes black, and the **Position** indicated is now the position of the key point. Type the new position of the key point.

- type the horizontal position of the key point you want to modify in the **Position X** box, then indicate the new vertical position of the key point. Note that you can't move the horizontal key point position using this method.

Deleting Key Points

To delete a key point, click on the handle ( ) of the key point you want to delete, or type its horizontal **Position** in the box **X**, then press the **Delete key point** button When you select a key point, you can jump to the next one by pressing Tab (Shift Tab jumps to the previous). You cannot delete the right-most key point.

Multicurve Editor



Multicurve Editor

Description

Multicurve editor is very similar to the Filter Editor.

The only difference is, instead having one filter, multicurve has several filters. These filters offer different possibilities to compute an output profile.

For each plant seed, one filter is randomly chosen among the filter list. Each filter of the list can be edited exactly as in Filter Editor.

Probabilities

This tab displays the list of filters contained in the multicurve.

You can **add** or **remove** filters by clicking on the two icons on the bottom right of the list.

Each line represents one filter.

Only the selected filter is editable. However, the other filters can be visible on the curve.

Each line contains different controls:

- **Visible:** Check this box to display the filter on the curve.
- **Name:** This lets you edit the name of the filter.
- **Proba(bility):** This lets you edit the probability of the filter. The higher the probability factor compared to other filters, the more likely this filter will be chosen upon plant seed change.
- **Filter:** Filter control representing the filter. This lets you edit the filter independently in another Filter Editor or load one of the sample filters.

Random range parameter

Random Range Parameter

Description

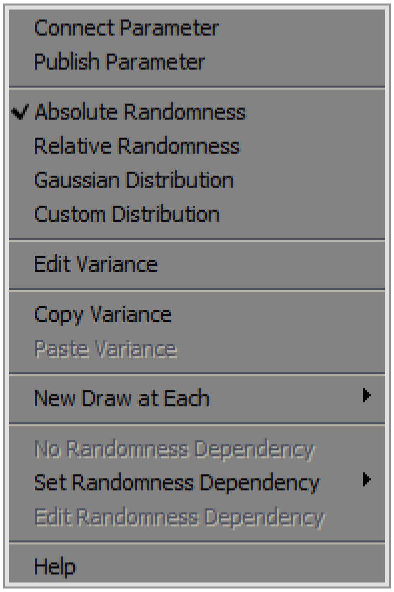
This parameter returns a value which can change depending on evaluation context. Its value can be edited by moving the slider with the left mouse button or typing it directly in the first numeric fields. Slider range adapts automatically to the value. Different effects can be applied to modulate this value.

Randomness

It is possible to add randomness to the value. It means that the value will no longer be a fixed value but it will be picked randomly from a range of values.

This range can be edited by moving the slider with the right mouse button or typing its value directly in the second numeric fields.

More randomness options are available in the contextual menu of this parameter. Click on the parameter field name to display the menu:



Contextual Menu

Randomness distribution:

- **Absolute:** value is picked uniformly in a fixed range (e.g. $10 \pm 1 \rightarrow [9; 11]$)
- **Relative:** value is picked uniformly in a range relative to the main value (e.g. $10 \pm$

20% → [8; 12])

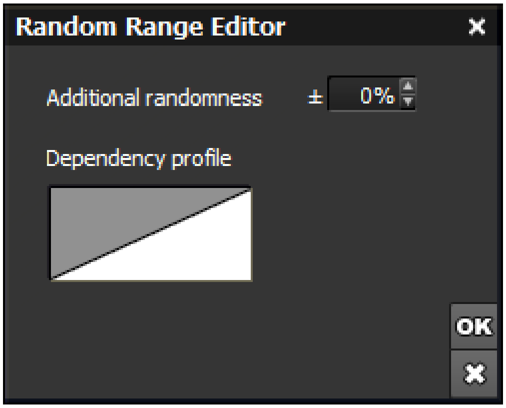
- **Gaussian:** value is picked using a gaussian distribution. Distribution variance is the defined range value.
- **Custom:** value is picked using a custom distribution.
- **Edit Variance:** allows editing of the variance of distribution.

  If the distribution is custom, it opens a Filter Editor with additional parameters:

  Distribution Editors

  - **Min:** minimum value of the distribution.
  - **Mean:** mean value of the distribution.
  - **Max:** maximum value of the distribution.
- **Copy/Paste Variance:** allows the copy of the randomness distribution to another parameter.
- **New Draw at Each:** choose when a new random value is picked:
  - **Parameter:** every time parameter is newly evaluated (only available when parameter is computed several time on the same primitive instance). e.g. two blades of the same branch will have two different parameter values.
  - **Primitive:** every time primitive instance is instantiated. e.g. Two branches build with the same node will have two different parameter values.
  - **Vegetation:** every new plant. e.g. Two plants build with the same graph will have two different parameter values.
- **Set Randomness Dependency:** link randomness to another parameter randomness. It means that parameter value will not be picked randomly but will be picked in function of the value of the parameter on which this parameter depends. The range of the parameter variation is editable as the basic randomness range.
- **Edit Randomness Dependency:** configure randomness dependency. You can add additional relative randomness to the variation from the dependency. You can edit the profile of this dependency



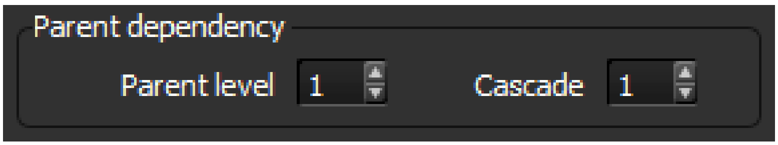
Random Range Editor

Primitive instance context

It is possible to modulate parameter value in the function of the primitive instance context thanks to the two filters on the right of the parameter interface.

- The first filter (orange one) modulates the parameter value in the function of the position on the primitive instance. e.g. branch radius can decrease at the end of the branch. Of course, this option is available only when it is useful. This filter is similar as any filter parameter.
- The second filter (green one) modulates the parameter value in the function of the position of the current primitive instancein its hierarchy. e.g. The more a branch is high in the tree, the shorter it is.

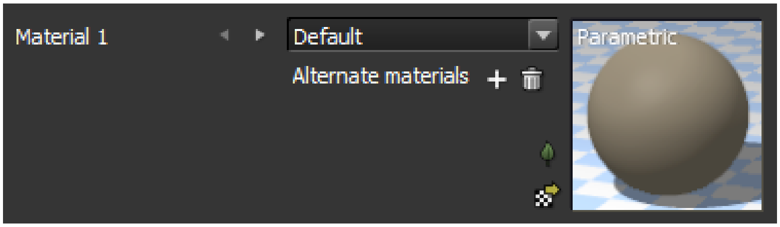
  This filter is very similar as the filter parameter. However, the Filter Editor contains some additional parameters:

  Parent Dependency

  - **Parent level:** hierarchy level until parent dependency is computed.
  - **Cascade:** takes into account all levels between the primitive instance and the defined parent level (1:only parent level, 0:All levels)

Material parameter



Material Parameter

Selection box

There are three kinds of options in the Material selection box :

- **Inherit from parent:** this applies the parent primitive instance material to the current primitive instance.
- **Existing materials:** the names of the known materials from the Material summary are displayed here. Select one of them if you want to use it for the current node too.
- **Load material:** this displays a Material browser that lets you select a .mat file.

To use a bitmap for the material, right-click on the material image and select **Edit Material** to open the Material editor. On the **Color and Alpha** Tab, select **Mapped Picture** and click the **Load icon** under the image. This opens an image browser that lets you select a bitmap.

Other buttons

- **Load:** also displays the Material browser.

For nodes with multi-material (see material distribution parameter):

- **Add/Remove:** these buttons allow to add/remove current material.
- **Arrow buttons:** these buttons allow to browse all materials.

For billboard or warpboard nodes:

- **Leaf Editor:** this button displays an editor to control leaf color and alpha channels, as well as the leaf hooking point.

Material Distribution Parameter

The **Distribution** parameter has no modifiable value. But it is connectable. Replacing the default Random node by a custom function that yields a value in $[0;1]$ allows to drive the choice of the material used in the primitive instance in case of multi-materials.

Material Editor

Materials are an important part of the quality of plants created in TPF. And the reason for this is twofold: TPF materials are not just 2D pictures mapped onto objects, they are truly three dimensional (which means when you carve into them, you actually carve into new parts of the material), and they are designed to respond to their environment (altitude, slope, orientation, etc).

Unfortunately, this visual quality has a drawback: creating materials can be a complex process. However, we have striven to keep it as simple and straightforward as possible, while maintaining full access to every aspect of material synthesis.

Each time you make a modification to a material, the material preview is redrawn by a multithreaded background task without slowing down the interface.

The Material Editor is accessed by double-clicking on the preview of a material, or by selecting

Edit Material from the popup menu that appears when you press the right mouse button (Ctrl mouse on Mac) over the material preview. It can stay open without restricting access to other parts of the software.

There are two types of Material Editors:

- the Basic Material Editor, ideal to setup basic texture mapped materials easily and,
- the Advanced Material Editor that gives you full access to all material parameters.

You can switch from one Material Editor to the other anytime by clicking the large button at the top-left of the Material Editor.

Types of Materials

Materials are divided into 2 types:

- Simple materials
- Mixed materials

Mixed materials are built by mixing together 2 other materials, either simple ones or mixed ones themselves.

Materials can also be layered to easily add e.g. stains to an existing material. Material layers work in a similar way to Photoshop layers in that they are added one on top of the other, and layers below are only visible in places where the layers above are nonexistent.

Multi-Materials

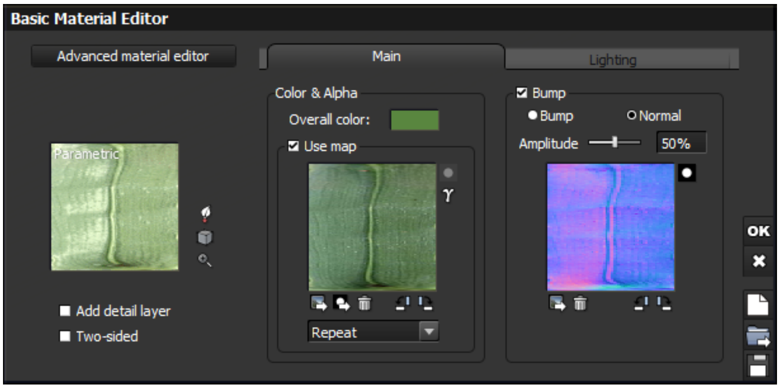
Multi-Materials are created by saving all of the materials of a selected object or plant as one material. These materials can then be accessed as a .mat file from the Material Browser, the saved image in the browser showing the different materials in the file. These materials are a convenient way to quickly change materials of objects. A specific multi-material should always be used on a specific object, so that the number of materials matches.

These materials are saved or loaded from the menu displayed by right-clicking on the window in the Object Properties panel.

Basic Material Editor

The Basic Material Editor is particularly convenient to easily set up texture mapped materials, or do basic modifications of existing materials. This version of the Material Editor won't let you access the entire range of effects possible, but it is a good way to begin with materials before you delve into the intricate complexity of the Advanced Material Editor (see the Advanced Material Editor page).

Main Tab



Basic Material Editor

If the current material is a Simple Material, the Basic Material Editor displays the controls described below.

Color & Alpha

The controls in this frame let you adjust the colors of the material.

- **Overall color:** this color control lets you modify the overall color of the material. Because the control displays an average color, this color may not be actually visible in the material. For instance, if the material exhibits a red and white checkerboard, the overall color will turn out pink – despite the fact that there is only red or white in the material. The overall color can be modified by double-clicking on the color control. All colors in the material will be modified in order to produce an average color that is the same as the one indicated by the overall color control.
- **Use map:** check this option if you want the material to be colored by a picture. Double-click on the picture preview or click the **Load** icon to load a new picture bitmap. If the picture contains alpha, this alpha can be used. Otherwise, you can load a specific alpha map by clicking on the second **Load** icon.

To create an animated texture map (Rotoscoping), select an animation file from the Bitmaps Browser, or press the **Browse file** button in the Bitmaps Browser to display a Standard File Browser and select multiple picture files. The **Animated texture options** icon will appear under the picture preview. Click this icon to display the Animated Texture Options dialog.

If you need to rotate the picture, use the and buttons (90° increments). To invert the colors in the picture, click the **Invert** button (). Click on the **Remove** button to delete the picture or animation.

Below the picture is where you can set tiling: repeating, mirror, once.

Bump

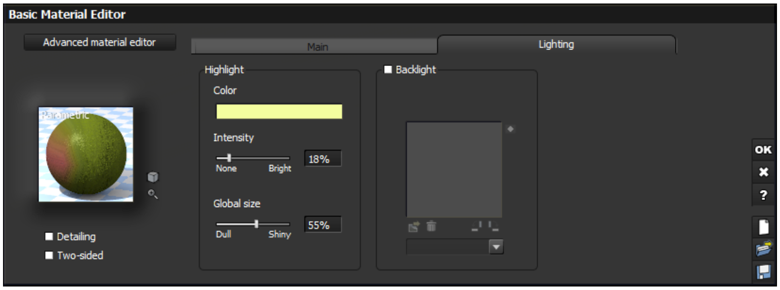
The controls in this frame let you adjust the bump of the material surface.

- **Bump or Normal:** this control adjusts the amount of bump at the surface of the material. The bigger the value, the bumpier the surface. Note that if the material does not define any bumps (either through the use of a bump map, or procedurally), no amount of bump gain will make bumps appear on the surface of the material.
- **Bump map:** check this option if you want the bumps at the surface of the material to be generated according to the grayscale values in a picture. Double-click on the picture preview or click the **Load** button to load a new picture.

If you need to rotate the picture, use the and buttons (90° increments). To invert the colors in the picture, click the **Invert** button. Click on the **Remove** button to delete the picture or animation.

- **Use color map:** if this option is selected, the same map will be used for the bump map as the one used for the color map.

Lighting



Lighting

The Light settings are made up of Hightlight and Backlight.

Highlight

- **Color:** You can select the highlight color by clicking on the color square and selecting a color from the color chart.
- **Intensity:** Set the intensity by using the slider to set the percentage.
- **Global Size:** Adjust the highlight from **Dull** to **Shiny** by using the slider.

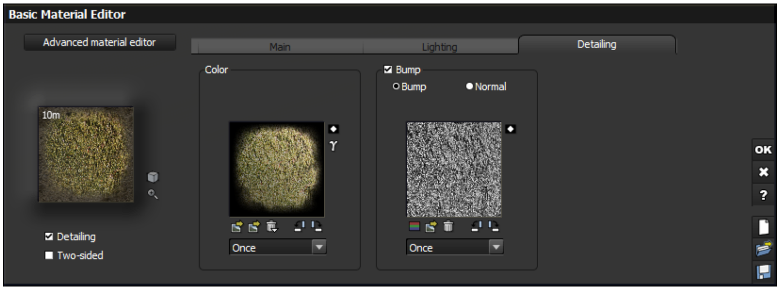
BackLight

When **Backlighting** is checked, you can use the Load icon to load an image for back-lighting. There is a setting for tiling. Your choices are: Repeat, Mirror and Once.

Detailing

This option is available in the left lower corner of the Basic Editor.

It allows to add a texture on top of the main material to add small details (moss, fungi,...)

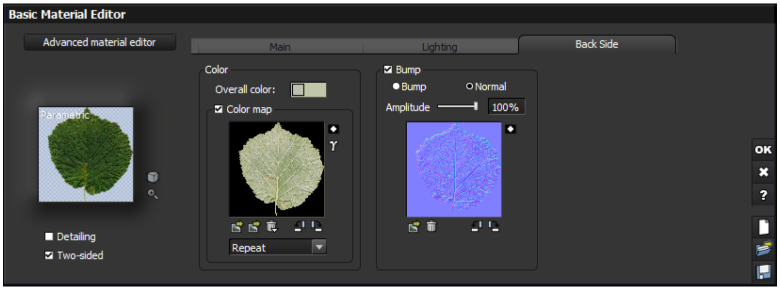


Detailing

Two-Sided

This option is available in the left lower corner of the Basic Editor.

It allows for a different texture on the back of your geometry. It is very useful for leaves.



Back side

Advanced Material Editor

The Advanced Material Editor lets you define more precisely the look of your materials. The downside to this is that this version of the editor is significantly more complex to master.

As with the Basic Material Editor, the lower part of the Advanced Material Editor changes according to the type of material being edited:

- Simple Materials
- Mixed Materials
- Two-Sided Materials

- Grouped Material

Driving Material Settings with Functions

In the Advanced Material Editor, a number of material settings are preceded by the **Drive with a function** icon. If you click this button, the setting will be driven by a function. The new node will display in the graph. That output node corresponds to the material parameter. A constant node will be connected to it, and the value held by this constant node will be the same as that of the material parameter before it was extracted. At this point, the material is not yet affected by the operation (except under very specific cases where the extraction of the parameter changes the way that parameter is interpreted – such cases will be clearly documented in the corresponding parameter descriptions). However, now that the parameter is extracted, you may drive it with any type of function.

If you go back to the initial node, you will notice that the **Extract parameter** button has been replaced by the **Disconnect parameter** button, and instead of displaying input controls, an indication that the node is "connected" appears. If you click the disconnect parameter button, or if you disconnect that parameter's output in the graph, the parameter will be reintegrated into the node and restored to its initial constant value.

The underlying power of this simple feature is truly amazing! This can be used to create totally unique material shaders. For instance, by connecting the highlight color to a function, you can create unique iridescent effects.

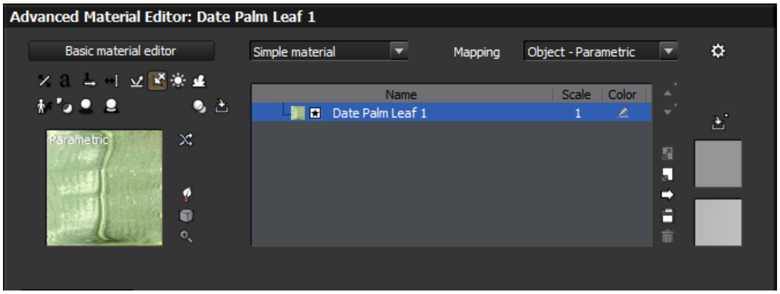
Published Parameters

The **Published Parameters** feature copies specific settings from the graph that you may need to change often and places them in a more convenient location for easier material manipulation. In the Advanced Material Editor, a new tab is created for these parameters.

To select a parameter for publishing, just click the publish button of the parameter in the graph. For example, if you are using a variable noise fractal for a material bump, you might want to publish the **Roughness** parameter. A parameter name is supplied and a group name is asked to improve the display of the published parameter. This parameter will then appear on a **Published** tab in the Material Editor so that you can change the settings there.

Common Material Controls

This section details the controls that are common to all types of materials.



Material Editor – Common Material Controls

New, Load, Save

In the dialog bar, on the lower right edge of the editor you will find these usual commands. The first, **New**, will reset all material characteristics so that you can start working on your material from a clean base. **Load** lets you open and detail the characteristics of an existing material using the Material Browser. Please note that if the material you are editing is animated, loading a material here will create a new material animation keyframe. **Save** lets you save the current material in a stand-alone file, for use in future scenes. Saved materials will appear in the Material Browser like any other of the predefined materials. By default, materials are placed in the Materials subfolder. This means that they will appear in the Personal collection inside the Material Browser.

Note that there are so many parameters involved in material creation, that it is usually easier to modify an existing material rather than to start from scratch.

Name

Use this field to rename the material. The name of the material also appears in the caption of the Material Editor.

These icons are only available in the Advanced Material Editor:

- **One sided:** If the icon is selected, it indicates that objects using this material should be traced for only one intersection per ray. This option is only available in the **Advanced Material Editor**. Since opaque objects block all rays at their surface anyway, **One sided** will only affect transparent materials. Rays actually never pass through a one sided object, so this should not be used with materials that have some fading out. Some effects (like Fuzziness) will force **One sided** to be activated.
  One sided objects can be very useful when rendering details on the surface of an object, while not wanting to see details on the opposite surface.
- **Disable anti-aliasing:** If this icon is selected, it lets you selectively disable anti-

aliasing on given materials. This option is only available in the Advanced Material Editor. On a general basis, anti-aliasing increases picture quality. However, some materials may lose their grainy aspect when anti-aliased, and you may want to remove anti-aliasing in such cases.

- **Hide from camera rays:** When this icon is selected, this material displays only through reflections or refractions.
- **Hide from reflected/refracted rays:** When this icon is selected, this material displays only when being viewed directly through the camera.
- **Disable indirect lighting:** Selecting this icon disables indirect lighting on the material being edited.
- **Disable caustics:** Selecting this icon disables any caustics that might be used with this material.
- **Ignore lighting:** Selecting this icon disables any influence that either sunlight or lighting sources such as a spotlight might have on this material.
- **Ignore atmosphere:** Selecting this icon disables any influence that the sun, ambient lighting or any other kind of atmospheric effect would have on this material.
- **Don't cast shadows:** Selecting this option will prevent the object from casting a shadow which can be useful for luminous objects. Deselecting this option when the shadow of an object is not needed (because it isn't visible) can also significantly improve rendering speed. This option is only available in the Advanced Material Editor.
- **Don't receive shadows:** When this icon is selected, objects made of this material will not be shadowed by other objects in the scene. Note that materials that have no diffuse lighting never receive shadows anyway. Since computing shadows is a time consuming process, you might want to turn shadows off where they are not required. This option is only available in the Advanced Material Editor.
- **Only shadows:** When this icon is selected, the object will not be directly visible in the rendered picture. It will however still cast a shadow on other objects. This is particularly useful when you want to create shadow-casting masks without actually seeing the mask. This option is only available in the Advanced Material Editor.
- **Matte / Shadow / Reflection:** When this option is selected, it will generate alpha masks that are proportionate to shadowing & reflected geometry at each shaded point. Global illumination shadowing is also taken into account and will also affect alpha masking accordingly.

Type

This is where you choose the type of material. The available types of material are:

- Simple materials
- Mixed materials

Selecting one of these options will toggle between the different types of materials. Additionally, simple materials can be layered (see Layered Materials).

Effects

- **TAA boost:** The Texture Anti-Aliasing boost offers the ability to adjust texture anti-aliasing quality on a specific material. Use the slider to raise or lower the amount of anti-aliasing compared with the global setting. Note that anti-aliasing must be enabled in the Render Options for this feature to have any effect.
- **Subray quality drop:** This feature allows you to decrease secondary rays quality (i.e. reflected or refracted rays) of the render for this particular material. Note that anti-aliasing must be enabled in the Render Options for this feature to have any effect. Render times can be reduced using this feature for materials where reflections and/or refractions are costly to evaluate while their contribution to the image is relatively low. This can be useful for water surfaces with strong perturbations, as the reflections and refractions will be blurred by these perturbations. Thus, each secondary ray quality can be reduced without altering the final image quality.
- **Mapping:** this drop-down list lets you select the mapping mode that will be used for the material. Since mapped pictures have their own specific mapping mode, they may be overridden inside a particular function.

Material Hierarchy

The material hierarchy is the list that sits in the middle of the Material Editor. This list displays all the different sub-materials and layers of mixed or layered materials. Mixed or layered materials can be expanded to display the different layers and sub-materials. If you click on one of these items, the Material Editor will change to reflect the settings of that sub-material or layer. Using the material hierarchy, you can easily access all the different components of the material.

Alongside each line of the material hierarchy is the **Highlight** switch. Click on this to highlight the corresponding sub-material or layer. Highlighted materials will be displayed using a solid color, thus letting you easily check where the material appears in a scene and adjust its contribution. When you are done adjusting the material, simply click this switch again to restore the normal colors of the material. You can adjust the highlight color by right-clicking (Ctrl+Click on Mac) on the color switch when the material is highlighted.

Layering Materials

Click the **Add layer** button to add a layer to the current material. The Material Browser will appear, letting you select the material you want to add as another layer to the current material. Closing the Browser will add an empty layer. If the current material is a simple or mixed, it will become a layered material, with at least two layers.

To remove a layer, select it in the hierarchy and click **Remove Layer**.

You can move layers up and down by clicking the Up and Down buttons alongside the material hierarchy.

Material Previews

In the middle of the Material Editor are square spaces that can contain materials. When you start, only the first square is occupied by a preview of your current material.

- **Randomize:** clicking this icon makes a random change to all fractal and noise nodes used for a material. You can keep clicking until you find the effect you like. This is only for use with procedural materials.
- **Preview Options:** Clicking the **Options** icon displays the Preview Options dialog.

  This dialog enables you to select which object should be used to preview **Preview Options** materials or functions. **Sphere** is the fastest, and **Cloud** should only be used for cloud materials. **XY Plane** displays a 2D representation of the material in perspective, whereas **2D Plane** presents the material on a plane seen from above.

  It also lets you choose a background type for the preview (**Uniform** or **Checker)**, as well as the **Background color** by modifying the color map (double-click on the map).

  Check **Local light** to use a local light rather than a directional light.
- **Zoom:** Clicking the **Zoom** icon displays an enlarged view of the material. Click on **Render** to re-render the preview; press **Esc** to stop.

Store

Selecting the **Store** icon copies the current material into the first available material preview (in the set of previews to the right of the material hierarchy), making it available for future retrieval. If you select **Restore This Version** (from the popup menu), or double-click on one of these stored materials, the corresponding settings are copied to the current material.

Simple Materials

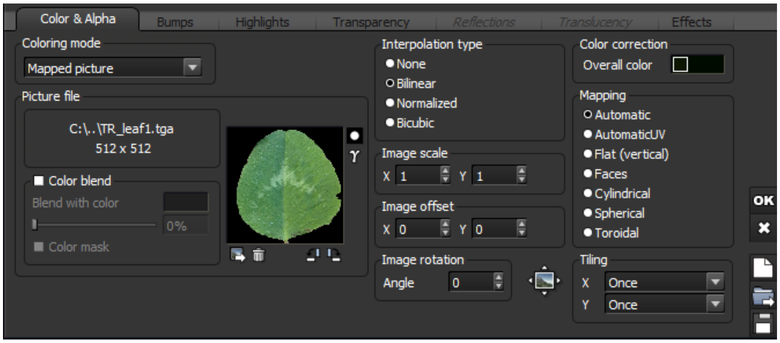
Simple materials are defined by 7 sets of parameters, each corresponding to a tab in the editor:

- Color & Alpha Tab: color of the surface.
- Bumps Tab: bumps on the surface (bump-mapping algorithm).

- Highlights Tab: specular reflections: is the surface shiny or dull?
- Transparency Tab: transparency / refraction of the material.
- Reflections Tab: reflections on the surface of the material.
- Translucency Tab: sub-surface scattering and translucency of the material.
- Effects Tab: local surface lighting and special effects.
- Environment Tab: defining presence of layers in a multi-layer material.

If the material is a layer of a multi-layer material (see Layered Materials), the **Alpha boost** control will appear on top of the tab control. This setting lets you control the overall "presence" of the layer in the multi-layer material. If you drag the slider towards positive values, the layer will appear stronger (within the limits of the environment constraints that you set using the **Environment** tab.

Color & Alpha Tab



Material Editor – Color & Alpha Tab

The **Color & Alpha** tab defines the color of the surface of the material and the corresponding opacity (alpha).

You can choose from 2 types of surface coloration:

- Mapped picture,
- Procedural colors.
- **Overall color:** this color control is common to the Mapped Picture and Procedural Color options. It lets you modify the overall color of the material. Because the control displays an average color, this color may not be actually visible in the material. For instance, if the material exhibits a red and white checkerboard, the overall color will turn out pink – despite the fact that there is only red or white in the material. The overall color can be modified by double-clicking on the color control. All colors

in the material will be modified in order to produce an average color that is the same as the one indicated by the overall color control.

Mapped Picture

You can use any picture to color the surface of a material.

First, you must indicate the picture that you want to use by clicking the **Load** icon and selecting a file from the Bitmaps Browser. You can change the name of the image (Picture File) by clicking on the image name in the Material Editor. This name can be changed in the graph as well.

To the right of the image, you can select to set the **Gamma** correction for this material, overriding the global settings.

To create an animated texture map (Rotoscoping) , select an animation file from the Bitmaps Browser, or press the **Browse file** button in the Bitmaps Browser to display a Standard File Browser and select multiple picture files. The **Animated texture options** icon will appear under the picture preview. Click this icon to display the Animated Texture Options dialog. See information below.

If you need to rotate the picture, use the arrow buttons (90° increments). To invert the colors in the picture, click the **Invert** button. Click on the **Remove** button to delete the picture or animation.

To create an animated texture map (Rotoscoping), select an animation file from the Bitmaps Browser, or press the Browse file button in the Bitmaps Browser to display a Standard File Browser and select multiple picture files. The Animated texture options icon will appear under the picture preview. Click this icon to display the Animated Texture Options dialog.

It is possible to load image sequences directly into a single multi-image sample node and it will distribute the loaded images randomly over the texture. To load a sequence one has to specify the path as a regular expression (for example, c:\img*.bmp will load all the img1.bmp, img2.bmp etc in c:\).

The advantage over creating several multi-image sample nodes and connecting them through an image combiner is that it's easier to use when one has many images and that the image overlapping order is not fixed. However, one cannot specify different distribution settings for these images (like density, rotation, scale etc).

To map the picture (2D by definition) onto a 3D volume, use one of the available mapping modes. Each of these mapping modes is best suited for some types of objects (e.g. spherical for Spheres).

Select one of the following:

- **Automatic:** The mapping technique is chosen automatically, depending on the object onto which the material is applied (e.g. Spherical for a sphere, cylindrical for a cylinder…).
- **Automatic UV:** This mapping technique is used for a 3D displaced textured terrain to allow for the generated mesh of the terrain at render time.
- **Flat:** Vertical projection / slide projector type, oriented so as to project the picture on the ground; values don't depend on altitude.
- **Faces:** Slide projector type of projection oriented along one of the three world axes. For each point, the projection axis is the closest axis to the normal vector of the object.
- **Cylindrical:** Mercator projection: the picture is wrapped around a cylinder around the vertical axis before being projected.
- **Spherical:** The picture is projected so that it covers exactly a sphere. Since the picture wraps around 180° vertically, and 360° horizontally, the scale seems to double vertically.
- **Toroidal:** The picture is projected so that it covers exactly a torus. A strange, and not very useful mapping mode, hum…

If you don't know which to use, select **Automatic**. Note that the shape of the object on which you project the picture does not have to be the same as the type of projection you choose.

You can control the way the picture is repeated along both axes using the **Tiling** drop-down boxes. Available options are:

- **Repeat:** this is the default. The image is repeated indefinitely along this axis.
- **Mirror:** in this mode, the image is also repeated indefinitely, however, it is mirrored each time so that the repetitions join seamlessly.
- **Once:** the image is displayed only once along this axis.

If you want the picture to tile symmetrically horizontally, select **Mirror X**; If you want the picture to tile symmetrically vertically, select **Mirror Y**.

When the material is seen from very close, you may see pixels, due to the limited resolution of the picture. To reduce this effect, choose an **Interpolation type** method:

- **None:** No over sampling.
- **Bi-linear:** Bi-linear interpolation between pixels.
- **Normalized:** Values proportional to the distance to the corners of the pixel.
- **Bi-cubic:** Bi-cubic interpolation between pixels (continuous derivative).

Indicate the **Scale** of the picture along the X and Y axes.

You can position the picture precisely on the object by using the **Image offset** commands. This will move the picture around by increments of one pixel.

The **Color blend** group lets you blend the colors of the picture with a solid color. To activate this feature, check the corresponding checkbox.

The color is applied in product mode, and the slider lets you adjust the amount of blending. The higher the value, the more the solid color modifies the picture.

Click **Color mask** to apply the color in replacement of the bitmap as the setting increases. When set to 0%, the color is applied as a mask. When set at 100% the color completely replaces the bitmap.

Procedural Colors

TPF can produce the colors of the material algorithmically, using a function, a filter and a color map.

This is how it works: for each point of the surface, the function calculates a value in the range of 0 to 1 (0 appears black on the preview of the function, 1 appears white). This value is then transformed by the filter into another value in the range of 0 to 1. The filter can be added in the graph. From this last value, the color map produces the color of the surface (if this value is 0, the color will be the one at the left end of the map, if it is 1, it will be the one at the right end).

All edits to the function can be done in the graph.

Use the scaling controls to scale the function along the X and Y and Z axes. If necessary, use the filter to modify how function values are transformed into colors (Control-click on the filter).

Finally, indicate which colors are assigned to the values of the function by editing the color map (Control-click on the map). Note that if the color map is solid (only one color), whatever the function and filter values might be, the material will always yield a uniform color.

Alpha Values

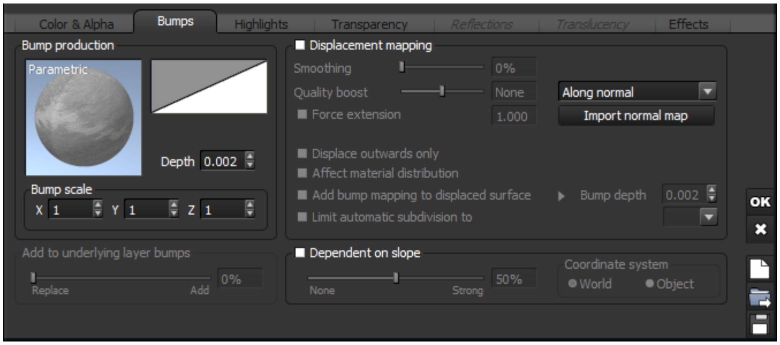
As well as colors, this tab can be used to control the alpha value of the material. Alpha is the same as non-refractive transparency. It can be used to “cut out” parts of a material, and is especially useful when working with layers. For instance, if you wanted to create a label using a bitmap, you would create a bitmap layer and connect the alpha channel so that the layer is completely transparent outside of the label. Alpha can also be used in conjunction with refractive transparency to “cut out” parts of glass materials.

If the surface of the material is colored by a bitmap, the alpha output is automatically connected to the alpha value of the image (fully opaque by default). Outside the image (if the image is not tiled), the alpha value is automatically set to 0 (fully transparent).

If the surface of the material is colored using procedural colors, the alpha output is connected to the alpha value of the color map.

Alpha values are especially useful to control the presence of a layer in a multi-layer material.

Bumps Tab



This tab describes bumps and holes that appear on the surface of the material. Bumps and holes are generated on the surface of the material using a function and a filter.

This is how it works: for each point on the surface, the function gives a value in the range of 0 to 1 (0 appears black on the preview of the function, 1 white). This value is then transformed by the filter into another value in the range of 0 to 1 that indicates the depth of the hole (or height of the bump) at this point (0 for a deep hole and 1 for a high bump).

To change the function, double-click on the picture of the function. The function parameters display in the parameters area.

Use the scaling controls to scale the function along the X, Y and Z axes.

If necessary, use the filter to modify the bump profile relative to the values of the function. Double-click the filter to open the Bump Filter Editor.

Finally, indicate a **Bump gain** in the corresponding box. The bigger the value, the bumpier the surface will be.

Displacement Mapping

To activate displacement mapping for this material, check the **Displacement mapping** option. All settings become available.

The **Smoothing** slider is used to remove any high frequency artifacts caused by displacement settings. Use the **Quality boost** slider to increase the amount of detail that is added to the geometry. Using the drop box to the right of the **Quality boost** slider, you can opt to constrain the displacement direction:

- **Along normal:**
- **Horizontal only:**
- **Vertical only:**
- **Normal map:** If this is selected, the Bitmap Browser displays for you to select a normal map. Or, you can use the **Import normal map** button to select a bitmap. When using normal maps, the object must have UV coordinates. If you try to apply a material with **Normal Mapping** to an object without UV coordinates (a primitive, typically), an error will display. If you are using the OpenGL Shader display mode, the normal map with be used in the OpenGL view. A diffuse map must also be present to use this feature.
- **Custom:** The **Custom** setting creates a new **Displace Direction** output node in the graph. It is expecting a 3D vector input.

Very high values will result in adding micro-polygons that are not even visible in the final render. If the results look jagged, increase the setting (you should only do this when you are finalizing your work in high quality render modes). The higher the setting, the better the material will look, but the longer it will take to render and the higher the memory overhead.

Using displacement mapping is extremely easy in TPF: just check a box! However, you should be aware that this feature adds an incredible level of complexity and memory overhead to your plants. Use displacement mapping with care – especially when creating very high resolution renders – because the amount of data added to the scene can become daunting.

Displacement mapping is designed to work with bump functions that output values in the standard range of -1 through 1. Any values outside this range will be clamped (i.e. when using fractal nodes with large features). When using displacement mapping, make sure that your bump production functions do not output values beyond this standard bump range. Values outside the valid range will automatically be clamped. This does not affect the amplitude of the displacement. You can create arbitrarily large displacements by entering large values of bump gain.

- **Force extension:** check this option to set the displacement extension manually. The displacement extension is a parameter that controls the maximum amount of possible displacement. Any value beyond this limit will be clamped (saturated). By default (when the **Force extension** option is not selected), the extension is automatically evaluated so as to encompass all possible displacement values generated by your bump production function. However, it may happen that values “outside” the extension range are generated, which will result in flat displacement areas appearing on the displaced objects (these areas are saturating). This can be fixed easily by turning on the **Force extension** option and increasing the default extension by hand. Conversely, if you want to create flat areas in the displacement, you could force a lower value for the extension.

Warning:

Remember that if you notice that parts of your displacement are clamped (they appear as flat surfaces), this indicates that the bump production function is outputting values outside the extension range. You can fix this by forcing a greater value for the maximum extension using the **Force extension** option and increasing the default extension by hand.

- **Displace outwards only:** when this option is selected, displacement values are adjusted so as to only produce positive values. As a result, the surface of the object will only be displaced outwards. This option is provided for compatibility with other applications that do not support negative displacement values (typically, in order to achieve similar results when using bitmap displacement maps created with such applications).
- **Re-evaluate material distribution after displacement:** when this option is selected, TPF will re-evaluate the contribution of environment-sensitive materials after displacement has been applied (typically so that the new displaced slope can be taken into account to determine material contribution).
- **Add bump mapping to displaced surface:** This feature makes it possible to render **Bump** in addition to **Displacement Mapping** to produce additional details. For example, you can create displacement mapping at a certain scale and add some bump mapping at a smaller scale. The **Additional Bump Mapping** channel can be edited on the graph.

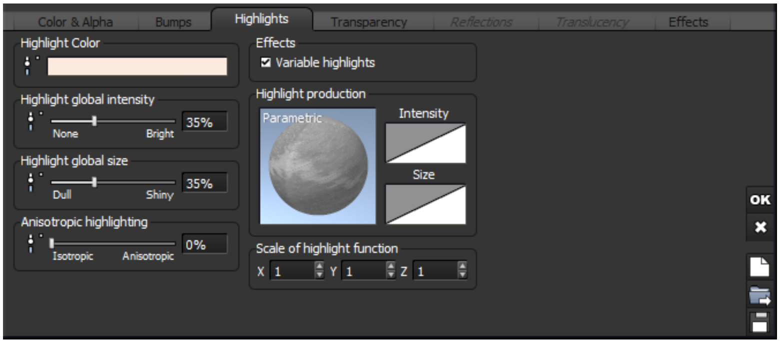
  Use **Bump Depth** to set the depth of this additional bump.

  You can choose to **Limit automatic subdivision** from 1X to 32X. Check the option and choose the value in the drop box.
- **Dependent on slope:** when this option is selected, a deeper displacement is produced on the vertical surfaces than on flat surfaces – which is the case in the nature, typically on eroded terrains. Use the slider to indicate the strength of slope influence. You can also set the **Coordinate system** to **World** or **Object**.

Add to Underlying Bumps

This option is only available when the material is a layer of a multi-layer material (and it isn't the bottom-most layer). Use this setting to control how the bumps of the current layer are added to the bumps caused by layers beneath it. If the value is 0%, the bumps of the underlying layer are replaced by the bumps of this layer. If it is 100%, the bumps are added.

Highlights Tab



Material Editor – Highlights Tab

This tab describes the surface quality of the material (shiny or dull). The specular highlights create spots of light on the surface of the object, in the direction of the light sources. The smoother the surface, the more concentrated and bright the spots will be (e.g., think of polished marble).

The highlights are built with two parameters: the intensity of the light spots that appear on the surface and the size of the spots.

Highlight color gives a uniform color shade to highlights. This is useful for modeling pearl-like materials (where highlights take on a blue color).

The **Highlight global intensity** corresponds to the average intensity of the light spots. Indicate a brilliance percentage (0% = no spots, 100% = very intense spots).

The **Highlight global size** controls the average concentration (size) of the light spots. Indicate a concentration percentage (0% = big spots for dull materials, 100% = small spots for smooth materials).

Anisotropic highlights are used to simulate the special type of highlights that appear on woven or fibrous materials. They are particularly useful to create realistic hair effects. Anisotropic highlights appear around a privileged direction, known as the "Scratch direction".

You can drive each one of these 4 parameters independently with a function by pressing the corresponding **Drive with a function** icons. For global intensity and size, this can also be achieved using the Variable highlights option described below. However, by extracting the parameters, you can drive the two parameters each one by a function that is in no way correlated to the other. See Driving Material Parameters with Functions for further details on driving material parameters with functions.

Variable Highlights

If you want the characteristics of the specular highlights to depend on position, select **Variable highlights**.

Variable highlights can be generated from a function and two filters, the first of which indicates the **highlights intensity** and the second the **highlight size**.

This is how it works: for each point of the surface, the function returns a number in the range of 0 to 1 (0 appears black on the preview and 1 white). The number is then transformed by the filters into an intensity and a size at this given point (0 for a dull surface, 1 for a shiny one). The maximum variable highlight value is the overall highlight value.

To modify the function, double-click on the function in the graph. The parameters are displayed. Use the scaling controls to scale the function along the X, Y and Z axes.

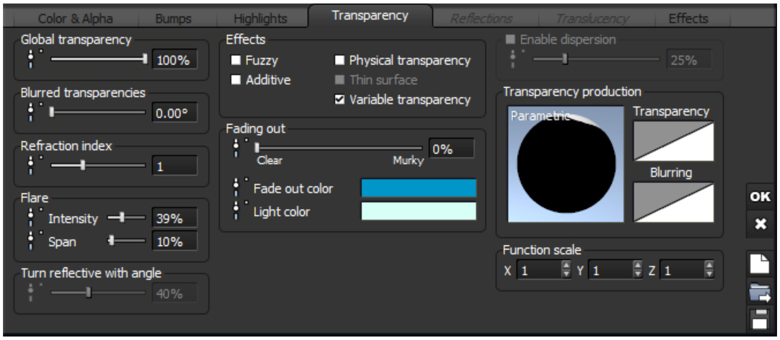
Indicate a highlight intensity with the **Intensity** filter (double-click the filter).

Indicate a highlight size with the **Size** filter (double-click the filter).

Bypassing the Standard Highlight Model

When editing material functions, you can define an additional output that does not correspond to any specific material setting. This output is known as **Highlight Value**. It expects a color value. If you connect a color node to that output, the color will be used as the highlight value. It will be evaluated for each light source, so that you can create a totally custom highlighting profile (e.g. create strong highlights at low angles of incidence).

Transparency Tab



Material Editor – Transparency Tab

This tab controls transparency and refraction over the surface of the material. Transparency can also be controlled via the alpha setting in the Color tab. This tab is not available in Simple materials that are layers of multi-layer materials (unless it is the bottom-most layer).

Alpha transparency and refraction are different in that transparency does not affect the direction of light, whereas refraction indicates that the direction of light is modified by the index of refraction of the material.

Incident light arriving on the surface of a material divides into 3 different lights:

- diffused light, sent by the surface in all directions, more intensely in the highlight direction; this makes the color of the surface,
- reflected light that bounces off the surface of the material, and
- refracted light (or transmitted); it is the light that goes through the surface and penetrates the material.

Some of the parameters in this tab can be driven independently with functions by pressing the corresponding **Drive with a function** icons. For global transparency and blur, this can also be achieved using the Variable transparencies option described below. However, by extracting the parameters, you can drive the two parameters each one by a function that is in no way correlated to the other. See Driving Material Parameters with Functions for further details on driving material parameters with functions.

Global Transparency

The quantity of light diffused is equal to the quantity of incident light less the quantity of refracted and reflected light.

Indicate the amount of light that penetrates the surface of the object using the **Global**

transparency control.

If you would like objects seen through the material to be blurred (because the material is impure or distorted), raise the value of **Blurred transparencies** up to non zero.

Refraction Index

The refraction index (a.k.a. Index of Refraction) identifies the optical density of the material. It bends rays of light that cross the surface of the material, thus creating the magnifying glass effect, and giving the impression that a stick in the water is broken. Common refraction indexes are:

- **Air:** Index of Refraction = 1.00. This is the reference IOR.
- **Water:** Index of Refraction = 1.33.
- **Glass:** Index of Refraction = 1.52.

You can modify the Refraction index of the material using the **Refraction index** control. Note that refraction indexes less than 1 are seldom observed, and would correspond to materials less dense than air…

Flare

When light is seen from behind a partially transparent material, it will cause the surface of the material to become very bright. This is called flaring. Flaring is a bit to transparency what highlights are to reflectivity. It will not occur at the surface of perfectly transparent materials. It is maximum for a transparency amount of 50%.

You control flaring through two settings: **Intensity** and **Span**. Flare span is the area around the light that will flare-up. Larger values yield bigger flares.

Turn Reflective with Angle

When a transparent refractive (i.e. IOR different from 1) material is seen at a low angle of incidence, it sometimes happens that it becomes reflective. Take a piece of glass, and look at it from the side. You will notice it acts as a mirror. The same thing happens with water: looking vertically, you see through it, but in the distance, it becomes reflective.

This behavior can be captured using the **Turn reflective with angle** control. You can even fine-tune that effect using the slider. Zero cancels it. Values around 40% yield good results. Light subdivides as it hits the surface of a material

Effects

- **Fuzzy:** selecting this option will make the edges of the object become fuzzy (blurred) instead of being sharp. The **Fade out** control changes into a **Fuzziness** control, letting you adjust the strength of the effect.

- **Additive:** When this option is selected, the color of the material is added to that of the background, yielding luminous, immaterial objects. This is an interesting effect for making light rays.
- **Physical transparency:** this option allows for a physical simulation of light volumetric scattering and absorption through transparent media. It is particularly suited for realistic glass and water simulation.
- **Thin surface:** this option allows you to render thin, one-sided surfaces such as a window, with reflectivity depending on the viewing angle BUT no refraction. The material must be one-sided. The refraction index should be different from 1, and **Turn reflective with angle** should be activated.
- **Variable transparency:** if you want transparency to be dependent on position, select the **Variable transparency** option.

TPF generates variable transparency from a function and a filter that indicates the amount of transparency depending on the value of the function.

This is the way it works: for each point on the surface, the function generates a number in the range of -1 to 1 (-1 is black on the preview of the function and 1 is white). This number is then transformed by the filter into a transparency value. The maximum variable transparency is equal to the overall transparency.

To change the function, double-click on the preview of the function. This displays the parameters. Use the scaling controls to scale the function along the X, Y and Z axes.

Indicate the values of the transparency using the filter (double-click on the filter).

Fading Out

When light travels through a material, it progressively fades out with distance. This is why deep water always looks blue. TPF captures such effects: indicate a **Fade out rate**, that is the depth at which light has completely disappeared and the color becomes that of the fade out color. If the value is small, the material will be clear, and you will see deep into it. If it is zero, no fading out will ever occur.

Indicate the **Fade out color** (double click on it), that is the color of the material when light has traveled deep into it.

Objects placed behind a transparent material, receive light of a color depending on the distance traveled through the transparent material. As light travels further through the material, it takes on a particular color that can be defined using the

Light color control. This is how you make blue water look green when sand gets close to the surface.

Enable Dispersion

Dispersion simulates the spectral decomposition of light through refractive media, like when light gets refracted through a prism. It corresponds to a physical law which tells that the index of refraction actually varies with incident light wavelength. To make this option work,

Compute physically accurate caustics render option must be enabled.

The dispersion value drives the amount of spectral dispersion when photons get refracted. Small values will tend to keep light quite concentrated, showing only a slight spectral decomposition, while large values will separate the spectrum more clearly.

Reflections Tab

Material Editor – Reflections Tab

This tab controls how the surface of the material reflects light.

Indicate the amount of reflected light in the **Global reflectivity** box. Note that if the amount of reflected light + the amount of transmitted light exceeds 100%, the material will become "luminous". If you are using radiosity it will actually be emitting light.

If you would like the surface of the material to be imperfectly reflective, resulting in distant objects appearing blurred inside the reflections, push up the value of **Blurred reflections** to non-zero.

Some of the parameters in this tab can be driven independently with functions by pressing the corresponding **Drive with a function** icons. For global reflectivity and blurred reflections, this can also be achieved using the **Variable reflections** option described below. However, by extracting the parameters, you can drive the two parameters each one by a function that is in no way correlated to the other. See Driving Material Parameters with Functions.

Variable Reflections

If you want the reflection to be dependent on the position, select **Variable reflectivity**. You must have set some amount of reflectivity for this option to be available.

Variable reflections are produced using a function and a filter that indicate the local amount of reflection depending on the value of the function.

This is the way it works: for each point on the surface, the function generates a number in the range of -1 to 1 (-1 is black on the preview of the function and 1 is white). This number is then transformed by the filter into a reflection amount. The maximum variable reflectivity is equal to the overall reflectivity.

Change the function in the graph. Use the scaling controls to scale the function along the X, Y and Z axes.

Indicate the amount of reflection using the filter.

Reflection Map

If you would like to use a reflection map to simulate the reflections on this material, check the **Use reflection map** option (you must have set some amount of reflectivity for this option to be available). The settings in the Reflection map group become available, letting you define a custom reflection map for this material. It also lets you set the default reflection map.

To define a new reflection map, press the **Load** button or double click the reflection map preview to open the Bitmap Browser. Select the picture you want to use as reflection map and validate. A message should appear if your picture doesn't loop smoothly horizontally, and offer to create a smoothed junction between both edges. This is because the reflection map is mapped onto an imaginary sphere, thus looping horizontally. If you click

Yes, then TPF will add a smooth transition strip from the right to the left border of the bitmap in order to avoid a sharp transitions in the reflection map. Of course, if you don't want to alter the bitmap, click **No**. Your bitmap should now be displayed in the reflection map preview.

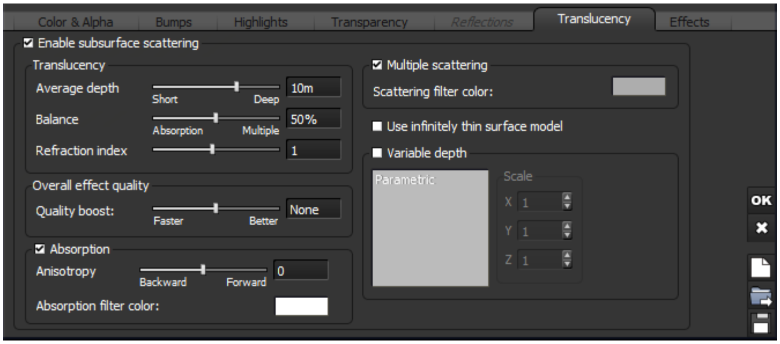
If you would rather use the default reflection map for this material, click the **Use default** button.

Adjust **U offset** and **V offset** values if you need to shift the reflection map bitmap horizontally or vertically.

If the reflections on this material are blurry (**Blurred reflections** set to non zero), the reflection map will automatically be blurred accordingly. Also, the reflection map preview will appear more or less blurred according to the blurring amount.

If you click the **Set default** button, the current reflection map will become the default and will be applied to all materials that use the default reflection map. The U and V offsets will also be applied to all materials that use the default reflection map.

Translucency Tab



Material Editor – Translucency Tab

This tab controls the translucent characteristics of the material. Translucent materials react to light in a very different way than "regular" materials.

With a regular material, incident light is either diffused, reflected, or refracted. With translucent materials, the light is also absorbed by the surface of the material and re-emitted at a point that is not the same as the point where it arrived. The technique used to capture this effect is known as subsurface scattering.

Translucency Settings

To enable translucency, activate sub-surface scattering for the material by checking the **Enable sub-surface scattering** box. When this option is selected, the sub-surface scattering controls become accessible. The Translucency group displays a set of controls that are common to absorption and multiple scattering.

- **Average depth:** this setting controls how translucent the material is. It indicates the average distance traveled by light inside the material. Typical "real-world" values are in the range of a fraction of a millimeter to a couple of centimeters (for wax-like materials). You must make sure that your translucent objects are compatible in size in order to see the effects of subsurface scattering (don't expect to see anything – except desperately-long render times – if you assign a translucent material with an average depth of 1 inch to a large surface).
- **Balance:** this setting controls the amount of absorption vs. multiple-scattering that takes place inside the material. The default is 50%, which means that all absorbed

light is redistributed by the multiple scattering, but you can achieve interesting effects by varying this balance.

- **Refraction index:** this is identical to the refraction index in the **Transparency** tab. When you enable sub-surface scattering, the refraction index control in the **Transparency** tab becomes disabled.

Absorption

Check this option to enable absorption for this material.

The **Anisotropy** setting controls how directional the scattering is inside the material. A value of 0 indicates that the light is scattered equally in all directions, a negative value indicates that light is scattered mostly backwards, and a positive value, that light is scattered forwards (the usual scattering).

Absorption filter color: this setting controls the overall color that light picks up as it travels through the translucent material (the red color when you put your finger over a light source).

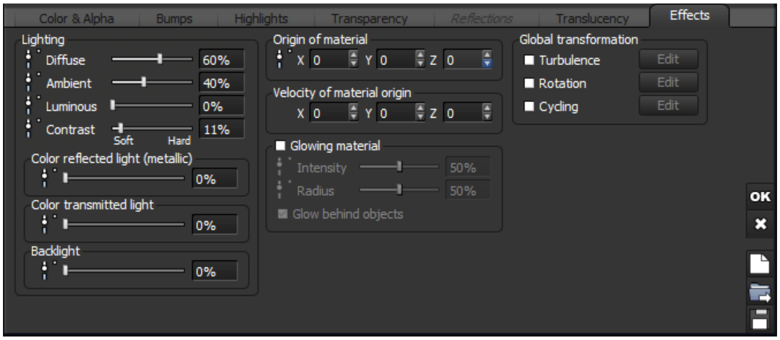
Multiple Scattering

- **Scattering filter color:** this setting controls the diffuse color of the material (the pink color of the skin). Because multiple scattering bounces light in all directions, there is no preferred direction for this effect (unlike absorption).
- **Use infinitely thin surface model:** select this option when rendering one sided translucent materials, such as planes.

Quality Boost

Quality boost: use this slider to increase the number of samples taken to compute the translucency. If the results look noisy, increase the setting (you should only do this when you are finalizing your work in high quality render modes). The higher the setting, the better the material will look, but the longer it will take to render.

Effects Tab



Material Editor – Effects Tab

This tab controls the lighting characteristics of the material, and miscellaneous effects.

Some of the parameters in this tab can be driven independently with functions by pressing the corresponding **Drive with a function** icons.

Lighting

The surface of the material receives light from light sources (e.g. the sun) and from the environment, and may react differently to each of these types lights.

The **Diffuse** lighting parameter controls the way the material reacts to light coming directly form light sources.

The **Ambient** parameter controls the way the material reacts to ambient lighting.

By default, these values are respectively 60% and 40%.

It is usually not recommended that you modify these values for a material except under very special conditions (e.g. you could make a cloud more reactive to ambient light, because the cloud is far enough, and physically different from solid objects in the foreground). This is because it may cause a mismatch between the different materials of your scene. Also, the total amount of Diffuse + Ambient should always be equal to 100%.

If you want to create materials that seem to emit light, use the **Luminous** setting. Keep in mind that luminous objects do not cast real light, though (except when using the Global Radiosity lighting model. If you wish to have a luminous object actually cast light, you could put a light source inside it and turn off **Casts shadows** for the material.

Luminous lighting is not affected by the global settings of the scene. This works particularly well when used in conjunction with Glow (see below), because it emphasizes the impression that the object is emitting light.

Contrast: this setting adjusts the speed at which the material goes from light to shadow. This is useful for modeling fluffy materials.

Color reflected light: to give a metallic aspect to a reflective material, select this option. This will give the color of the surface to highlights and reflections.

Color transmitted light: selecting this option with a transparent material will give the color of the surface to the light crossing it. This is a great for colored glass and church windows.

Backlight: use this option when a material is supposedly thin enough to let some light show through when illuminated from behind. This is typically what happens when the sun shines behind a leaf. The leaf isn't dark – light passes its surface, although it isn't transparent.

Origin of Material

These fields let you offset the material in material coordinate space. This enables the precise positioning of materials on objects.

If the material is completely animated (see Animated Material), TPF will automatically compute the corresponding velocity, and fill the **Velocity of the material origin** fields with the resulting values.

Velocity of Material Origin

These fields let you define a displacement with time of the origin of the material. As a result, the material will be changing as time passes. Defining a Velocity of material origin creates a Velocity Animated material. The keyword "Time dependent material" appears in the caption of the Material Editor.

Changing the velocity of the material origin of a completely animated material will set the fields in the **Origin of material** group.

Glowing Material

Select this option to create a haze of light around the material. Keep in mind that glow is a post-processed effect added once the rendering pass is complete. So when the render starts, you won't be able to see the glow. You need to wait until rendering is complete to be able to judge the effect.

When you select this option, the controls in the group become available. The **Intensity** slider controls the amount of light in the glow, and the **Radius** slider controls the average size of the haze of light.

Select **Glow behind objects** if you want the glow to be visible on objects that are placed in front of the glowing material. Uncheck it if you want the glow effect to be masked by objects in front.

The color of the glow is determined by the color of the material. Dark materials won't glow much.

Adding some luminous lighting to glowing materials emphasizes the glowing effect (see above). Remember that, although glowing materials give the impression that they are emitting light, no real light is actually cast by the material onto other objects in the scene. If you want a glowing object to actually cast light, you can add a point light inside it, and uncheck the

Casts shadows option.

Global Transformation

Selecting options in this group will apply global modifications to the material.

When you select an option, the corresponding **Edit** button becomes enabled. Pressing this button displays a dialog that lets you adjust the effects.

Global Turbulence

Press the **Edit** button to the right of the **Turbulence** checkbox to display the Turbulence Editor.

Using a noise, turbulence repeatedly displaces the location at which the material or the function is being evaluated. Turbulence is defined by 4 parameters (complexity, scale, amplitude and harmonics), a noise type and a combination mode.

Complexity defines the number of times the noise is repeated.

Amplitude is the average displacement applied by the noise to the material or to the function layer.

Scale controls the frequency at which the Noise functions vary relative to position.

Harmonics characterize the way the noise is scaled each time it is added: for each new addition, scale and amplitude are multiplied by the harmonic parameter. If the complexity is equal to 1, the harmonic parameter has no meaning.

Suggestion: to understand correctly the effects of turbulence, watch the variation of a material made from simple functions (e.g. use a rectangular wave noise to drive the color channel).

Basic noise defines the type of noise that is added to the current position, and

Combination indicates how successive noise applications should be combined.

Rotation

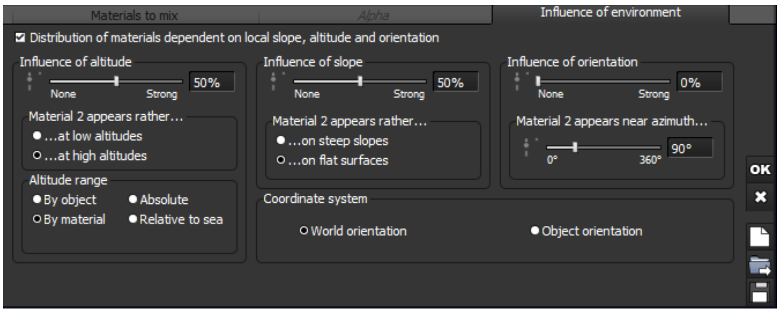
Pressing the **Edit** button on the side of the **Rotation** checkbox brings up the Transformation Editor.

Cycling

Cycling is a large scale perturbation of the material that helps to prevent it from looking too repetitive.

Environment Tab

If the current material is a layer of a multi-layer material, and if it is not the bottom-most layer on the stack, an additional tab called Environment is available. This tab lets you control how the environment affects the presence of the current layer.



Material Editor – Environment Tab

Altitude Constraint

This group lets you control how altitude influences the presence of the layer:

- **Altitude range:** this dual slider lets you define the range of altitudes in which the current layer appears (provided it is not transparent at this point). The layer will not appear outside this range.
- **Fuzziness:** this setting controls how "suddenly" the changes to the layer presence are made in response to altitude. High values mean that the layer appears very gradually in its altitude range, whereas low values will result in the layer appearing as a solid strip.

- **Range of altitudes:** this lets you define in what coordinates the altitude range is defined:
  - **By object:** in this mode, the range is relative to each object to which the material is applied.
  - **By material:** in this mode, the range is relative to all the objects that use this material.
  - **Absolute:** in this mode, the range of altitudes is expressed in global coordinates.
  - **Relative to sea:** the altitude is computed from the sea level and not from zero.

Slope Constraint

This group lets you control how the local slope influences the presence of the layer:

- **Slope range:** this dual slider lets you define the range of slopes in which the current layer appears (provided it is not transparent at this point). The layer will not appear outside this range. Values to the right end of the slider indicate flat surfaces, and values to the left indicate upside-down surfaces. Intermediate values indicate vertical surfaces. Slope values can range from -180 to +180 degrees.
- **Fuzziness:** this setting controls how "suddenly" the changes to the layer presence are made in response to slope. High values mean that the layer appears very gradually in its slope range, whereas low values will result in the layer appearing as a solid strip on areas of appropriate slope.

Influence of Orientation

This group lets you control how the local orientation influences the presence of the layer:

- **Preferred orientation:** this setting controls the orientation of the surface that is the most favorable to the presence of the layer.
- **Orientation influence:** this setting controls the influence of orientation on the presence of the layer.
- **Fuzziness:** this setting controls how "suddenly" the changes to the layer presence are made in response to orientation. High values mean that the layer appears very gradually on surfaces of the preferred orientation, whereas low values will result in the layer appearing as a solid strip on areas of preferred orientation.

Mixed Materials

A mixed material takes two materials and mixes them together. Mixed materials supply a number of rules that you can use to define the way the materials mix together, including rules that depend on the environment. It's a great way to change the material effects on trunks and branches.

Using these rules, a mixed material decides if, at any given point, it should be the first or the second material that shows, or a blend of the two.

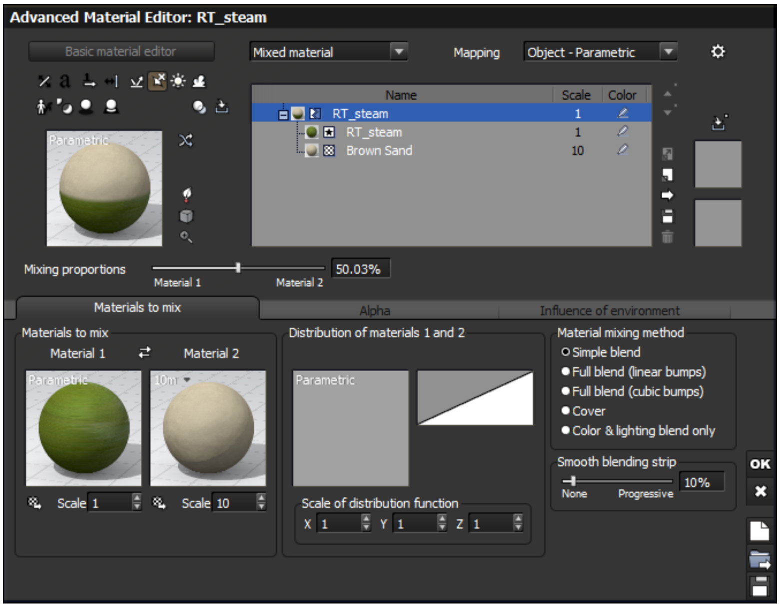
You can mix together simple materials, materials that are themselves a mix of other materials (create nested material hierarchies for amazing effects).

When you select the **Mixed materials** option at the top of the Material Editor, the tab part of the editor changes, displaying three tabs.

The **Mixing proportions** slider lets you adjust how much each of the two materials that are mixed together will be visible. Pushing the slider to the right will have more of the second Material showing, while pushing it to the left will show more of the first.

The **Alpha Channel** can also be edited for **Mixed materials**.

Materials to Mix Tab



Material Editor – Materials to Mix Tab

The first tab lets you choose the materials that will be mixed together, and the way they will be mixed.

Change the materials by loading materials that already exist on the disk with the button, or by double-clicking on the material preview to edit it.

Materials inside a mixed material can be scaled independently using the **Scale** controls. This only modifies the size of the material once it is applied to an object. A scale equal to 1 does not change the size of the material.

Distribution of Materials

To decide if the mixed material should display the first or the second material, or a blend of the two, TPF basically uses a function and a filter.

This is how it works: for each point on the surface, the **Distribution function** generates a value in the range of 0 to 1 (0 appears black on the preview of the function and 1 white). This value is then transformed by the filter into another value in the range of 0 to 1, which is then compared to the

Mixing proportions setting. If it is much less than this setting, material 1 is displayed. If it is far greater, material 2 is displayed. If the result is close to the Mixing proportions, inside a range indicated by the **Smooth blending strip**, a blend of the two materials is computed, in order to get smooth transitions from one material to the other.

The way materials mix can also be modified by local slope, altitude and orientation. See second tab.

Use the scaling controls to scale the function along the X, Y and Z axes.

If necessary, use the filter to further adjust the distribution of materials.

Smooth Blending Strip

The width of the strip inside which materials are blended can be adjusted using the **Smooth blending strip** control. Pushing it to the right will make for smoother transitions, while pushing it to the left will yield fast transitions.

Blending Method

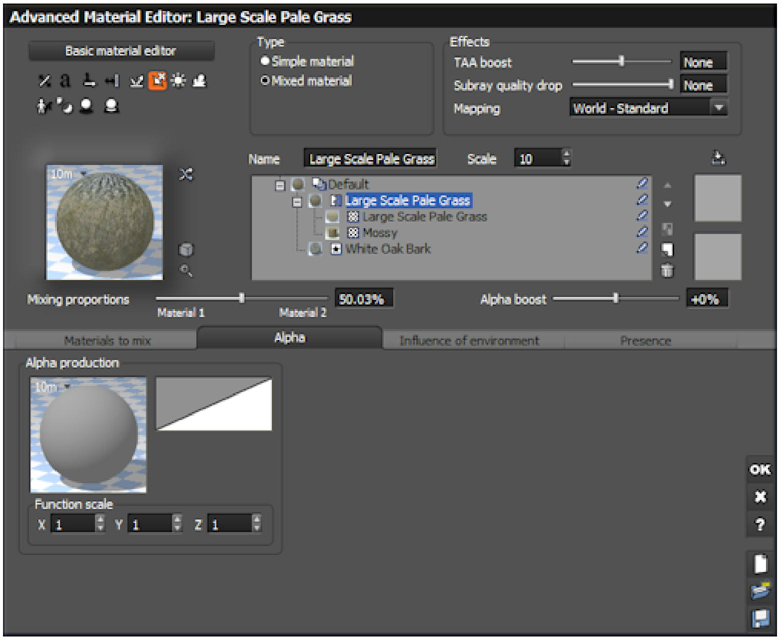
Inside the strip, materials are blended together. Bumps can be handled in several ways, depending on the result you are looking for:

- **Simple blend:** the surface aspect of the two materials are mixed together. This is the default. This method is compulsory to mix materials that are themselves mixed materials.
- **Full blend (linear bumps):** the characteristics of the two materials are blended together before the material is rendered. Surface heights are blended linearly, resulting in a chamfer between both materials (provided one of them has a higher

surface bump than the other).

- **Full blend (cubic bumps):** same as blend bumps, except heights are blended following a cubic rule. The result is a rounded chamfer between the two materials (like snow on rocks).
- **Cover:** no smooth transition for colors, only for bumps. Material 2 seems to cover up material 1. Inside the transition strip, only material 2 is visible.
- **Color and lighting blend:** in this mode, only color and lighting (ambient and diffused) features are used from Material 2, retaining all other features of material 1. This is useful for shifting colors of a material, without having to duplicate it.

Alpha Tab



Material Editor – Alpha Tab

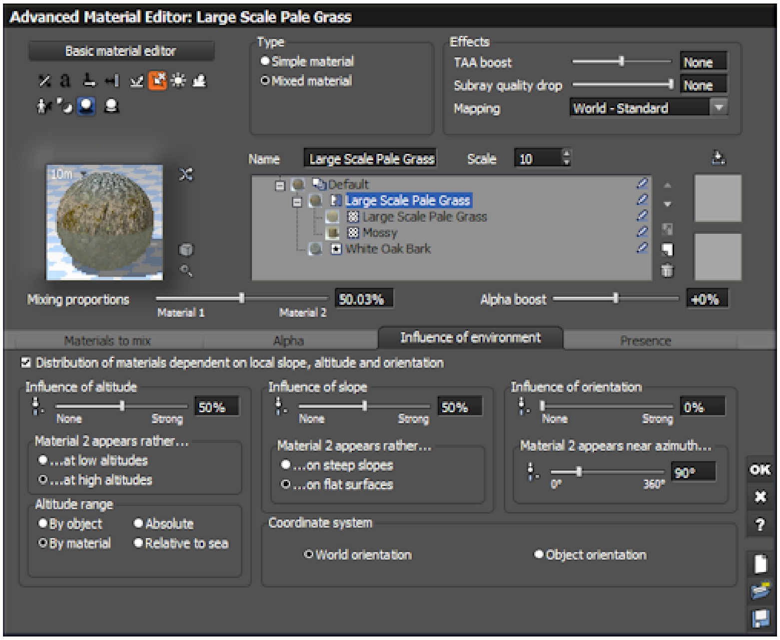
Alpha production can be edited on this tab. You can load a new filter by right-clicking the displayed filter and selecting

Load Filter to access the Filter Browser. Or, you can edit the current filter by right-clicking the displayed filter and selecting

Edit Filter to open the Material Alpha Filter dialog.

You can also modify the alpha channel by adding functions to the graph.

Influence of Environment Tab



Material Editor – Influence of Environment Tab

The third tab of the mixed materials editor lets you define the influence of slope, altitude, and orientation on the way the two materials are mixed together. Controls in this tab become active once you select the option **Distribution of materials dependent on local slope, altitude and orientation**.

Some of the parameters in this tab can be driven independently with functions by pressing the corresponding **Drive with a function** icons. See Driving Material Parameters With Functions for further details on driving material parameters with functions.

- **Influence of altitude:** adjusts the influence that altitude has on the distribution of materials. Zero means that the distribution is not affected by altitude. Non-zero values mean that material 2 will appear more often at high (or low) altitudes. Indicate whether the second material should appear at high or at low altitudes by selecting the requested box.
- **Influence of slope:** adjusts the influence that slope has on the distribution of materials. Zero means that the distribution is not affected by slope. Non-zero values

mean that material 2 will appear more often on steep slopes (or on flat surfaces). Indicate whether the second material should appear on steep parts of your scene, or on flat surfaces by selecting the requested box.

- **Influence of orientation:** adjusts the influence that orientation has on the distribution of materials. Zero means that the distribution is not affected by orientation. Non-zero values mean that the second material will appear more often on parts of the scene that are facing the azimuth indicated by the **Azimuth** slider. For a realistic distribution of snow on a landscape, you could for example indicate that snow appears mostly at high altitudes and that it tends to gather on flat surfaces. You could also make snow accumulate on faces of the landscape that are in shadow (using orientation).
- **Altitude Range:** lets you define in what coordinates this range is defined:

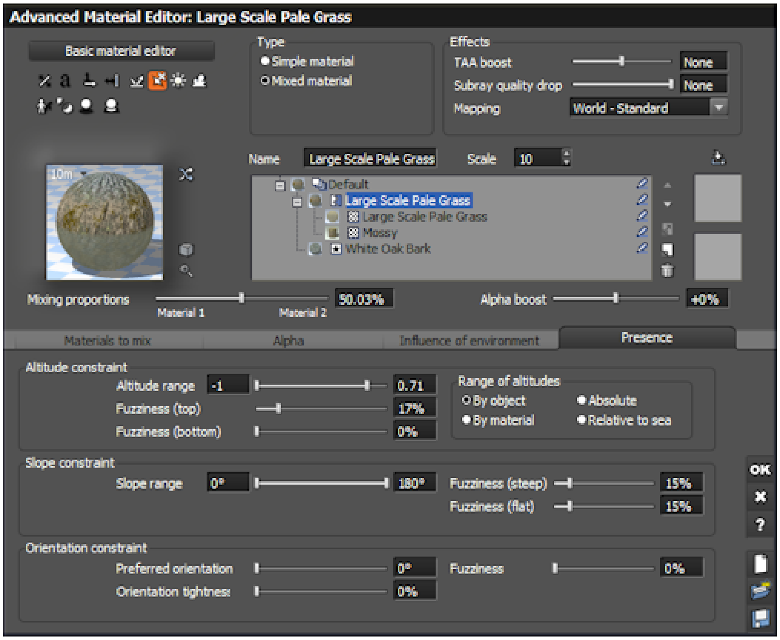
  Per object: in this mode, the range is relative to each object to which the material is applied.

  Global: in this mode, the range is relative to all the objects that use this material.

  Absolute: in this mode, the range of altitudes is expressed in global coordinates.

  Relative to sea: in this mode, the range of altitudes is expressed in global coordinates, but the altitude is computed from the sea level and not from zero.
- **Coordinate System:** this group lets you indicate if the environment considered for mixing the materials should be linked to the object itself, or to the world. If the environment is linked to the object, rotating the object won't change the distribution of materials on the surface (the distribution moves with the object).

Presence Tab



Material Editor – Presence Tab

This tab lets you control how the environment affects the presence of the current layer. The behavior of this tab is identical to that of the

Environment tab of **Simple materials** (see Environment Tab).

Altitude Constraint

This group lets you control how altitude influences the presence of the layer:

Altitude range: this dual slider lets you define the range of altitudes in which the current layer appears (provided it is not transparent at this point). The layer will not appear outside this range.

Fuzziness: this setting controls how "suddenly" the changes to the layer presence are made in response to altitude. High values mean that the layer appears very gradually in its altitude range, whereas low values will result in the layer appearing as a solid strip.

Range of altitudes: this lets you define in what coordinates the altitude range is defined:

- **By object:** in this mode, the range is relative to each object to which the material is applied.
- **By material:** in this mode, the range is relative to all the objects that use this material.
- **Absolute:** in this mode, the range of altitudes is expressed in global coordinates.
- **Relative to sea:** the altitude is computed from the sea level and not from zero.

Slope Constraint

This group lets you control how the local slope influences the presence of the layer:

Slope range: this dual slider lets you define the range of slopes in which the current layer appears (provided it is not transparent at this point). The layer will not appear outside this range.

Fuzziness: this setting controls how "suddenly" the changes to the layer presence are made in response to slope. High values mean that the layer appears very gradually in its slope range, whereas low values will result in the layer appearing as a solid strip on areas of appropriate slope.

Influence of Orientation

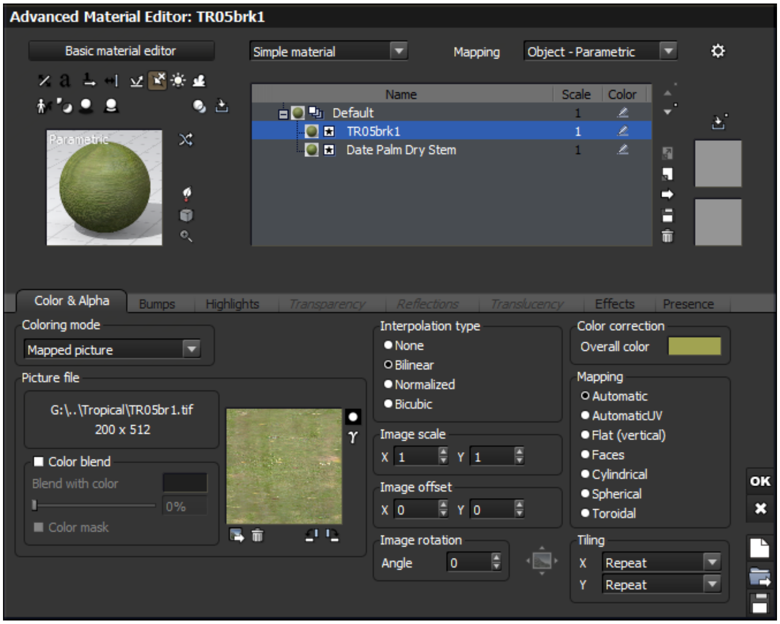
This group lets you control how the local orientation influences the presence of the layer:

Preferred orientation: this setting controls the orientation of the surface that is the most favorable to the presence of the layer.

Orientation influence: this setting controls the influence of orientation on the presence of the layer.

Fuzziness: this setting controls how "suddenly" the changes to the layer presence are made in response to orientation. High values mean that the layer appears very gradually on surfaces of the preferred orientation, whereas low values will result in the layer appearing as a solid strip on areas of preferred orientation.

Layered Materials



Material Editor – Layers

The Material Editor offers extended control over the creation of complex materials through a layered system. With material layers, you can:

- Add, delete, and rename layers on the fly.
- Move layers up and down in the stack.
- Each layer has its own alpha channel.
- Each layer has its own independent reaction to altitude, slope and orientation.
- Create mixed materials with any number of sub-materials.
- Easily navigate even the most complex layered/mixed/nested materials.

Layers can be Simple or Mixed.

Note:

To be recognized as detailing layer and displayed in the preview, a layer need to fill some conditions. To create such layer you can use the Basic Material Editor or load the detailing layer available in the *Environment* folder

Multi-Layer Materials

When a multi-layer (or layered) material is selected, the **Advanced Material Editor** appears as opposite. The Layer stack lists all layers used in this material.

When evaluating the layered material, TPF renders each layer in turn, starting with the top of the stack. If a layer is partially transparent (alpha is less than 1), or doesn't exist at that point (e.g. because of environment constraints), it moves on to rendering the layer beneath it on the stack. And so on, until total opacity is achieved or the bottom-most layer has been reached. Bumps at the surface of Simple materials are processed in the same way, except that bumps from a given layer are added to the bumps of the layer beneath it (unless the **Add to underlying bumps** option is set to 0.

Adding a Layer

You don't have to select a multi-material to add a layer to a material: simply select the line where you want to add the layer in the **Material Hierarchy** and press the **Add layer** button to the right of the hierarchy. The Material Browser appears, letting you select the new layer to add to the material. The layer is added immediately above the layer that was previously selected.

If you want to create a new layer without loading a preset material, just click **Cancel** in the Material Browser. A new "empty" layer will be added.

You can delete a layer by selecting it in the **Material Hierarchy** and pressing the **Del layer** button to the right of the hierarchy.

Changing the Order of Evaluation

You can change the order in which layers are evaluated by selecting a layer and pressing the **Up** and **Down** buttons to the right of the **Material Hierarchy**, or by dragging it in the list with the mouse. If you move a layer up, it will be evaluated earlier on the stack, appearing "on top" of other layers. Using the left mouse button, this also affects the environment settings.

If you use the right mouse button to reposition the layers, the environment settings are not affected. Any distribution mapping you have done remains the same; only the materials are swapped.

Influence of Layers

Layers can be placed according to their environment, using the **Environment** tab of the Material Editor when the layer is selected. Using this tab, you can constrain the layer to appear only at given altitudes, on given slopes or at given orientations. Please check the Environment Tab for details.

The placement of the bottom-most layer on the layer stack cannot be influenced by environment (it has to be "everywhere").

Material Snapshots

You can store a snapshot of a particular layer, by selecting the layer and clicking on the **Material Snapshot** icon, located to the far right above the last column. If you left-click another material or layer, it's snapshot goes in the lower box; the next layer you select will go in the lower box and the previous material stored is moved to the upper box. Now, if you select a material and right-click you can select which box that snapshot will be stored in.

The Shared Material Layer

This feature is a way to allow you to create a layer in a material that can be shared by other materials in your scene. A modification on a shared layer in a material will modify this layer in any other materials it is used in. You can have many shared material layers.

To make a shared layer, right-click on the layer and select **Share layer**.

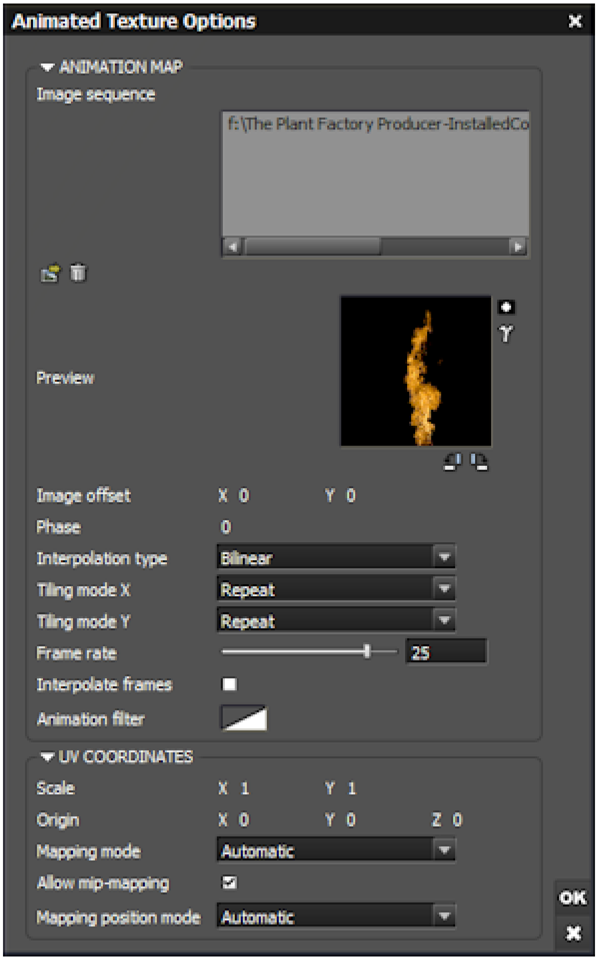
In order to add a shared layer onto an existing material, you can use the **Add shared layer** command from the contextual menu. This option is only available if you have previously created shared layer(s) in the scene. This operation is also accessible from the **Summary of Materials** window.

In the Material Editor (Advanced or Basic), you also have an **Add Shared Layer** icon right above the **Add Layer** icon to perform this operation.

In order to "dissociate" a material layer previously added through the **Add shared layer** command, you have a **Make unique** command in the material menu (only in the Material Editor). By making a material layer unique, you dissociate it from the other materials previously sharing it. It means that further edition of this layer will not affect other materials anymore.

There is a new pictogram to identify shared layers easily. Note that only Simple materials can be shared.

Animated Textures Options



Animated Texture Options

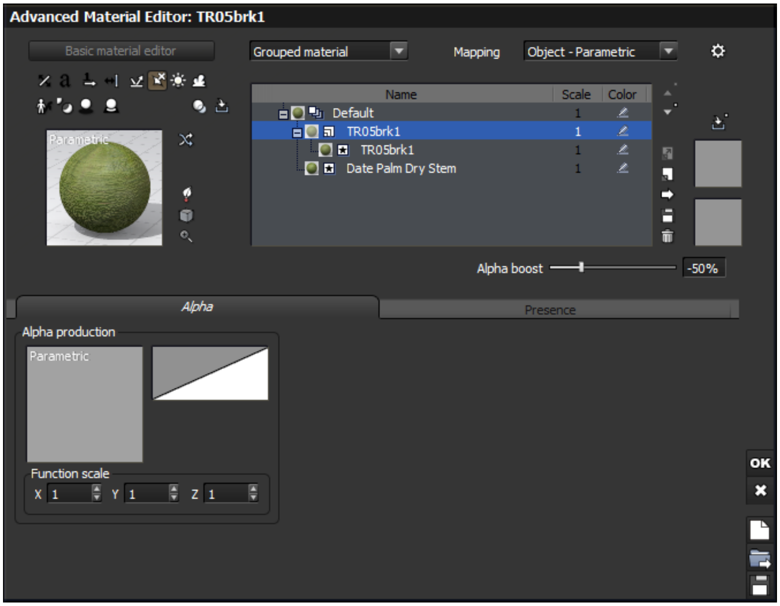
The **Animated Texture Options** dialog can be accessed by clicking the **Animated texture options** button in the Material Editor. This button appears below the texture map previews, when a sequence of pictures or an animation has been loaded.

This dialog lets you customize the way animated texture maps are displayed.

- **Image sequence:** this is the list of pictures to use in the animation. You can add new pictures by clicking the **Load** icon. You can replace pictures in the list by selecting them and then clicking **Load**. To remove images from the list, select them and then press the **Remove** icon.

- **Frame rate:** this defines the playback rate of the pictures on the list. Ideally, this should at least be equal to the global animation frame rate.
- **Interpolate frames:** when this option is selected, in-between frames are interpolated by gradually blending the previous and the next frames. This ensures smooth playback and will avoid any jumps in the animated texture.
- **Animation filter:** use this filter to change the flow of time in the animated texture. Double-click on the filter to load a filter, or select **Edit** from the filter's popup menu to edit the filter.
- **Phase:** use this to adjust the start frame in the animation sequence. The value has to be set in seconds.
- **Interpolation type**, **Picture scale** and **Mapping mode:** are identical to the settings in the Color tab of the **Advanced Material Editor**. Changes made to these settings will be immediately reflected in the **Advanced Material Editor**.
- **Origin:** defines the point of origin of the projection – e.g., when mapping in spherical coordinates, defines the center of the sphere.

Grouped Material

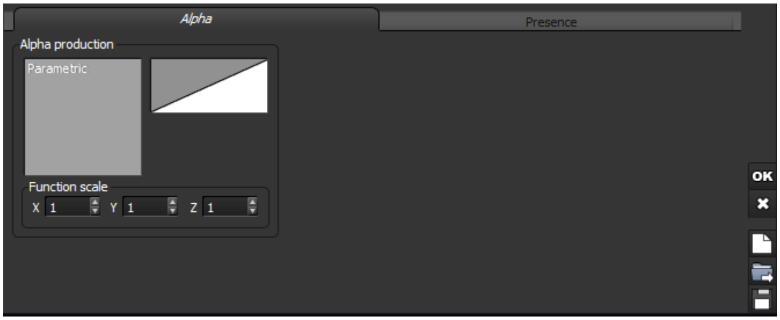


Grouped Materials

Unlike Layered Materials, you can control multiple layer presence driven by one item in the materials list. Alpha is also controlled for all layers.

Alpha Tab

Alpha production can be edited on this tab. You can load a new filter by right-clicking the displayed filter and selecting **Load Filter** to access the Filter Browser. Or, you can edit the current filter by right-clicking the displayed filter and selecting **Edit Filter** to open the *Material Alpha Filter* dialog.



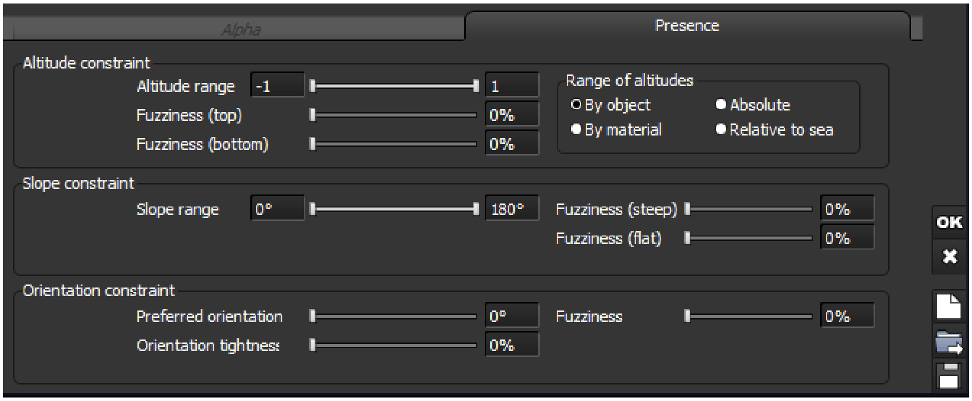
Material Editor – Group Material

You can also modify the alpha channel by using the *Function Editor*. Access the *Function Editor* by right-clicking the **Alpha production** picture and selecting **Edit Function**. You can also select to load a function from the Function Browser by selecting **Load Function** from the menu.

Presence Tab

This group lets you control how altitude influences the presence of the layer:

- **Altitude range:** this dual slider lets you define the range of altitudes in which the current layer appears (provided it is not transparent at this point). The layer will not appear outside this range.
- **Fuzziness:** this setting controls how "suddenly" the changes to the layer presence are made in response to altitude. High values mean that the layer appears very gradually in its altitude range, whereas low values will result in the layer appearing as a solid strip.
- **Range of altitudes:** this lets you define in what coordinates the altitude range is defined:
  - **By object:** in this mode, the range is relative to each object to which the material is applied.
  - **By material:** in this mode, the range is relative to all the objects that use this material.
  - **Absolute:** in this mode, the range of altitudes is expressed in global coordinates.
  - **Relative to sea:** the altitude is computed from the sea level and not from zero.



Presence tab-Group Material

Slope Constraint

This group lets you control how the local slope influences the presence of the layer:

Slope range: this dual slider lets you define the range of slopes in which the current layer appears (provided it is not transparent at this point). The layer will not appear outside this range. Values to the right end of the slider indicate flat surfaces, and values to the left indicate upside-down surfaces. Intermediate values indicate vertical surfaces. Slope values can range from -180 to +180 degrees.

Fuzziness (steep): this setting controls how "suddenly" the changes to the layer presence are made in response to slope. High values mean that the layer appears very gradually in its slope range, whereas low values will result in the layer appearing as a solid strip on areas of appropriate slope.

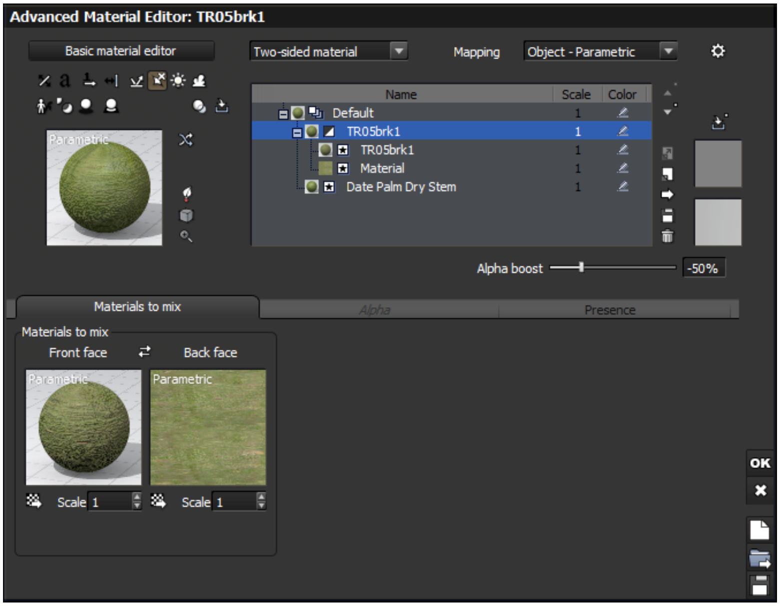
Fuzziness (flat): this setting controls how "suddenly" the changes to the layer presence are made in response to flat areas.

Influence of Orientation

This group lets you control how the local orientation influences the presence of the layer:

- **Preferred orientation:** this setting controls the orientation of the surface that is the most favorable to the presence of the layer.
- **Orientation influence:** this setting controls the influence of orientation on the presence of the layer.
- **Fuzziness:** this setting controls how "suddenly" the changes to the layer presence are made in response to orientation. High values mean that the layer appears very gradually on surfaces of the preferred orientation, whereas low values will result in the layer appearing as a solid strip on areas of preferred orientation.

Two-Sided Material



Material Editor – Two-Sided Materials

Two-sided materials allow you to define two different materials to each facet of a two sided object like a leaf. Only a few object types are supported: TPF plants, planes, alpha planes, terrains and meshes (imported or baked objects.

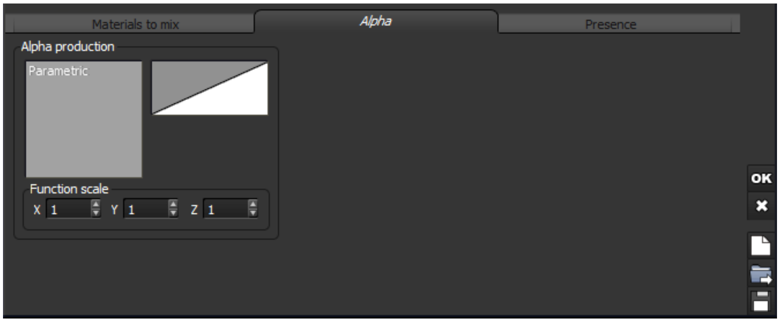
Materials to Mix Tab

This tab is used to select the materials to use.

Front Face – Back Face: Select the two colors to use, one for each face. You can switch the colors from front to back by clicking on the double-arrow icon.

Each of these materials can be edited by clicking on the material. You can mix together simple materials, materials that are themselves a mix of other materials (create nested material hierarchies for amazing effects!), or even EcoSystem materials.

Alpha Tab

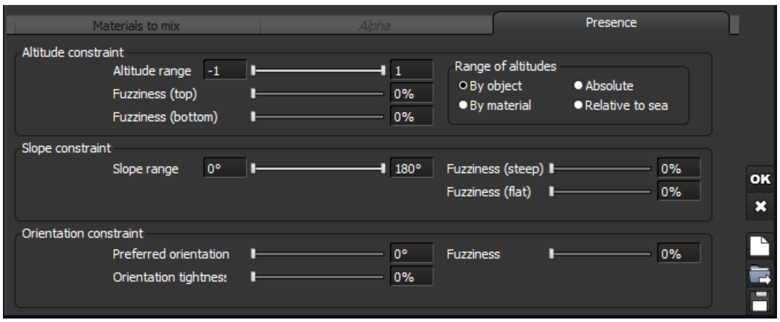


Material Editor – Two-Sided Material Alpha

Alpha production can be edited on this tab. You can load a new filter by right-clicking the displayed filter and selecting **Load Filter** to access the Filter Browser. Or, you can edit the current filter by right-clicking the displayed filter and selecting **Edit Filter** to open the *Material Alpha Filter* dialog.

You can also modify the alpha channel by using the *Function Editor*. Access the *Function Editor* by right-clicking the **Alpha production** picture and selecting **Edit Function**. You can also select to load a function from the Function Browser by selecting **Load Function** from the menu.

Presence Tab



Material Editor – Two-Sided Material Presence

This group lets you control how altitude influences the presence of the layer:

- **Altitude range:** this dual slider lets you define the range of altitudes in which the current layer appears (provided it is not transparent at this point). The layer will not appear outside this range.

- **Fuzziness:** this setting controls how "suddenly" the changes to the layer presence are made in response to altitude. High values mean that the layer appears very gradually in its altitude range, whereas low values will result in the layer appearing as a solid strip.
- **Range of altitudes:** this lets you define in what coordinates the altitude range is defined:
  - **By object:** in this mode, the range is relative to each object to which the material is applied.
  - **By material:** in this mode, the range is relative to all the objects that use this material.
  - **Absolute:** in this mode, the range of altitudes is expressed in global coordinates.
  - **Relative to sea:** the altitude is computed from the sea level and not from zero.

Slope Constraint

This group lets you control how the local slope influences the presence of the layer:

Slope range: this dual slider lets you define the range of slopes in which the current layer appears (provided it is not transparent at this point). The layer will not appear outside this range. Values to the right end of the slider indicate flat surfaces, and values to the left indicate upside-down surfaces. Intermediate values indicate vertical surfaces. Slope values can range from -180 to +180 degrees.

Fuzziness (steep): this setting controls how "suddenly" the changes to the layer presence are made in response to slope. High values mean that the layer appears very gradually in its slope range, whereas low values will result in the layer appearing as a solid strip on areas of appropriate slope.

Fuzziness (flat): this setting controls how "suddenly" the changes to the layer presence are made in response to flat areas.

Influence of Orientation

This group lets you control how the local orientation influences the presence of the layer:

- **Preferred orientation:** this setting controls the orientation of the surface that is the most favorable to the presence of the layer.
- **Orientation influence:** this setting controls the influence of orientation on the presence of the layer.
- **Fuzziness:** this setting controls how "suddenly" the changes to the layer presence

are made in response to orientation. High values mean that the layer appears very gradually on surfaces of the preferred orientation, whereas low values will result in the layer appearing as a solid strip on areas of preferred orientation.

Advanced Breeze Response Parameter

Advanced Breeze Response Parameter

Advanced Breeze Response parameter allows to override global breeze settings for this node.

- **Left-clicking on the icon:** allows to **edit** the breeze settings using an Avanced Breeze Response editor.
- **Right-clicking on the icon:** allows to **enable/disable** overriden breeze settings.

Spline parameter

Spline parameter allows to define primitive shape using Spline editor.

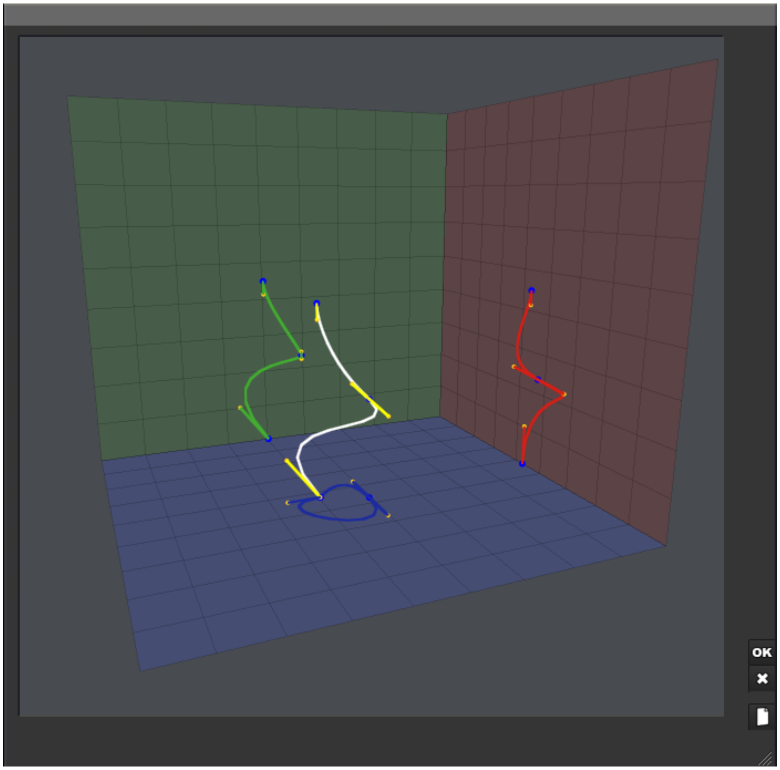
There are three kind of Spline editors

Axis Spline Editor

Overview

The goal of this editor is to draw a 3D spline.

The main spline is drawn in white. The red, blue and green planes are used to represent all three projections of the spline. The main spline as well as its projections are all adjustable with the mouse.



Axis Spline

The spline

The spline is a continuous third-degree polynomial curve that passes through several control points.

Moreover, tangent vectors at each control point allow to finely tune the exact axis of the spline.

Buttons

- **OK** : validates the currently edited spline and closes the editor.
- **X (Cancel)** : cancels all changes and closes the editor.
- **New** (white sheet) : resets the spline to default, a straight vertical spline with two control points.

3D view

- It is possible to **pan**, **rotate**, **zoom**, **unzoom** in this editor just like in the 3D plant preview. Please refer to the Options dialog to configure 3D view navigation.

Control points manipulation

- **Left-click** somewhere on the main spline to **add** a new control point there.
- **Right-click** on a control point to **delete** it.
- **Left-click** on a control point and keep the mouse button down while **dragging** to **move** the control point.

These actions can also be done on any of the three projection planes.

Tangents manipulation

The spline tangents are displayed at each control point. It is either possible to :

- change both half-tangents at the same time
- work on only one half-tangent. Hit the **B** key and keep it down as long as you want to stay in this **broken-tangent mode**.

Left-click on a tangent extremity and keep the mouse button down while **dragging** to **modify** the tangent vector. You can also make the tangent vector shorter or longer, this will affect the tangent influence on the spline. As for control points, this can also be done on projections.

Profile-Section Spline Editor

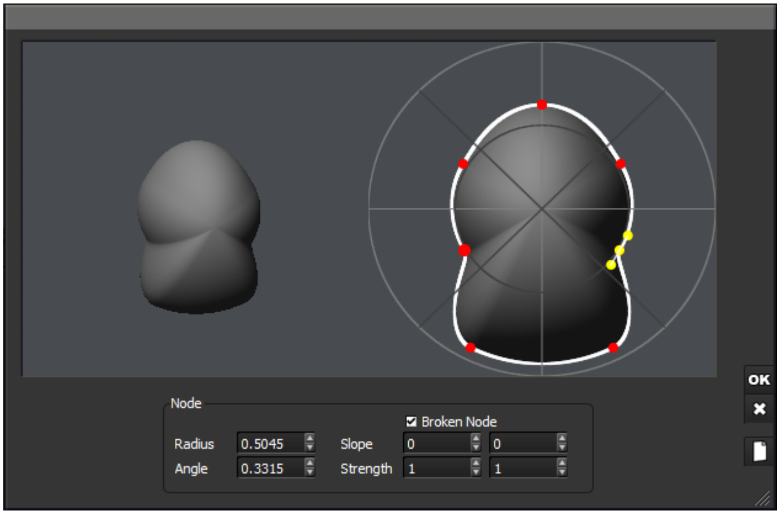
Overview

The goal of this editor is to draw a radial 2D spline.

There are two main sections in this editor :

- The left half displays a **3D preview** of a sphere with the defined profile applied along its Z-axis. This is a mere visualization tool.
- The right half is where you make your changes to **configure** the spline. A section of the left-part shape is shown.

The lower part of the dialog displays properties of the selected point.



Profile Spline

The spline

The spline is a continuous symmetrical polar curve that passes through several control points.

Moreover, tangent vectors at each control point allow to finely tune the exact shape of the spline.

Buttons

- **OK** : validates the currently edited spline and closes the editor.
- **X (Cancel)** : cancels all changes and closes the editor.
- **New** (white sheet) : resets the spline to default, a circular spline.

3D view

- It is possible to **pan**, **rotate**, **zoom**, **unzoom** in the left part of this editor just like in the 3D plant preview. Please refer to the Options dialog to configure 3D view navigation.

Control points manipulation

This applies to the right half of the editor.

- **Left-click** on an existing control point to **select** it. This displays the control point properties in the lower part of the dialog.
- **Left-click** anywhere else to **add** a new control point.
- Hit the **Delete** key when a control point is selected to **delete** it.
- **Left-click** on a control point and keep the mouse button down while **dragging** to **move** the control point.

For more precise point manipulation it is possible to manually enter the required polar coordinates of the selected point using the **Radius** and **Angle** fields located at the bottom of the dialog.

Tangents manipulation

The spline tangents for the selected control point are displayed. It is either possible to :

- change both half-tangents at the same time
- work on only one half-tangent. Check the **Broken Node** box.

Left-click on a tangent extremity and keep the mouse button down while **dragging** to **modify** the tangent vector. You can also make the tangent vector shorter or longer, thus affecting the tangent influence on the spline.

For tangents it is possible to manually enter the **slope** (tangent direction) and **strength** (tangent length) using the fields located at the bottom of the dialog. The second fields remain grayed unless the **Broken Node** mode is activated. In this case they are used to display the slope and strength of the second half-tangent.

Section Spline Sets Editor

Overview

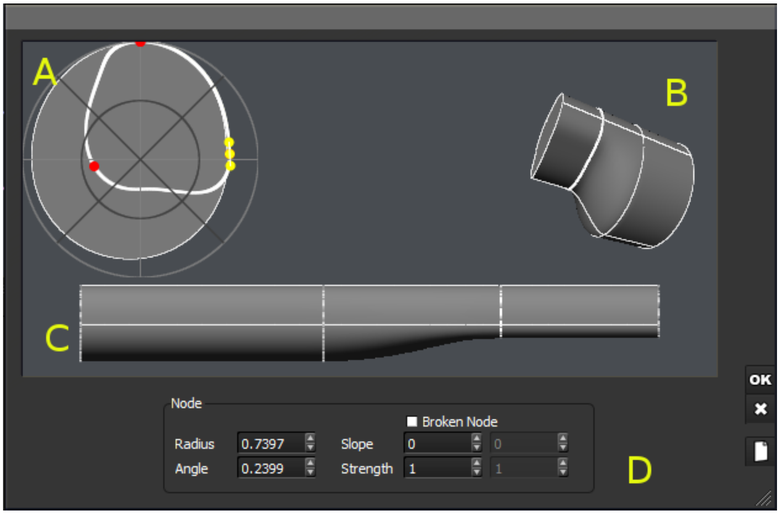
The goal of this editor is to draw a 3D cylindrical surface.

There are four sections in this editor :

- (A) **Section curve editor**
- (B) **3D preview**
- (C) **Longitudinal editor**
- (D) **Control point properties editor**

(A) and (D) are equivalent to the parts found in the Profile-Section Spline Editor.

The usual workflow first involves defining sections in (C), then drawing the spline for each one in (A) and (D) while controlling the result in (B).



Section Splines Set

The section splines set

The cylindrical surface is defined using some particular cross-sections along the cylinder vertical axis. These sections are 2D polar splines that can be individually configured using control points and tangents. The whole surface is then generated by interpolation between all cross-sections.

Buttons

- **OK:** validates the currently edited section splines set and closes the editor.
- **X (Cancel):** cancels all changes and closes the editor.
- **New** (white sheet) : resets the section splines set to default, a perfect cylinder.

Section curve editor (A)

Control points

- **Left-click** on an existing control point to **select** it. This displays the Control Point Properties Editor (D).
- **Left-click** anywhere else to **add** a new control point.
- Hit the **Delete** key when a control point is selected to **delete** it.
- **Left-click** on a control point and keep the mouse button down while **dragging** to

move the control point.

Tangents

The spline tangents for the selected control point are displayed. It is either possible to :

- change both half-tangents at the same time
- work on only one half-tangent. Check the **Broken Node** box in (D).

Left-click on a tangent extremity and keep the mouse button down while **dragging** to **modify** the tangent vector. You can also make the tangent vector shorter or longer, thus affecting the tangent influence on the spline.

3D preview (B)

This is a mere visualization tool. No actions on the section splines sets are possible here.

It is possible to **pan**, **rotate**, **zoom**, **unzoom** just like in the 3D plant preview. Please refer to the Options dialog to configure 3D view navigation.

Longitudinal editor (C)

This is another 3D preview of the surface which can only be seen as a side view. You can define here which particular cross-sections are used for surface generation.

- **Left-click** anywhere to create a new section.
- **Left-click** on a section to select it. The selected section is displayed in yellow and its polar spline is then displayed in (A).
- Hit **Delete** when a section is selected to delete it.
- Select a section and keep the mouse button down while moving horizontally along the cylinder to move the section.
- Right-click and keep the mouse button down while moving vertically to rotate the cylinder around its axis.

Control point properties editor (D)

For more precise control point manipulation it is possible to manually enter the required polar coordinates of the selected point using the **Radius** and **Angle** fields located at the bottom of the dialog.

For tangents it is possible to manually enter the **slope** (tangent direction) and **strength** (tangent length) using the fields located at the bottom of the dialog. The second fields remain grayed unless the **Broken Node** mode is activated. In this case they are used to display the slope and strength of the second half-tangent.

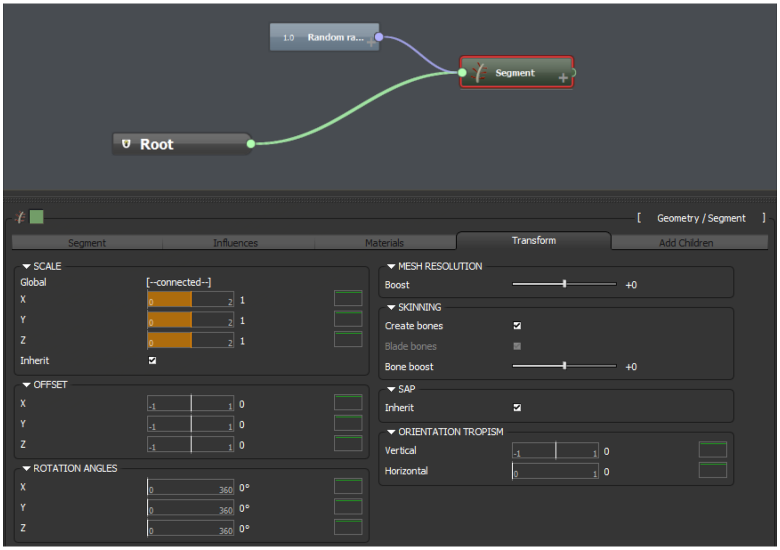
Parameter Extraction

Motivation

Sometimes directly setting the value of a parameter is not enough, for example if complex dependencies are expected. It is therefore possible to do as if the parameter value were the final computation result of a subgraph. That's the point of extraction (also referred to as connection). Extracting a parameter allows to connect it to other nodes of the graph.

Extraction

Most node parameters are extractable. To connect a parameter, **left-click** on its name and select **Connect Parameter** from the popup menu. This will create a new node connected to the node you were working on and replace the parameter value by [**--connected--**].



Parameter Extraction

Now create the graph of nodes you want and connect it using the newly-created connection. You can then delete the extracted node if you don't use it. You are then done!

Hovering over the parameter line with the mouse paints all graph nodes connected to the parameter in red.

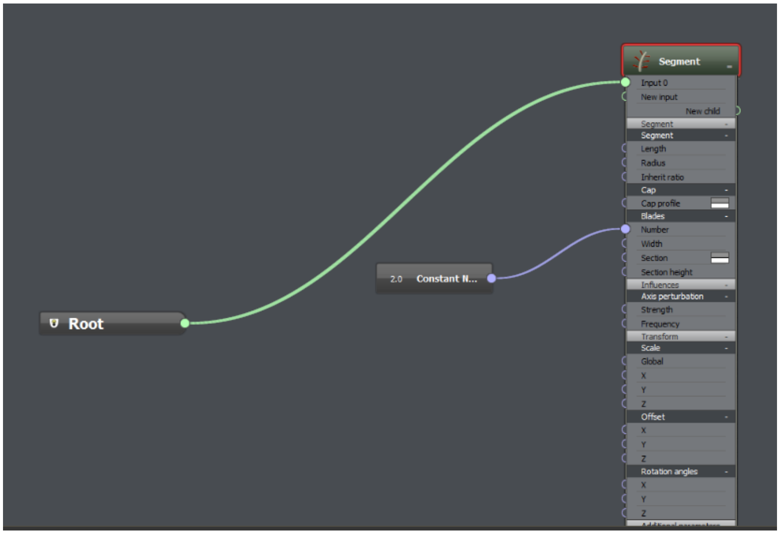
Cancelling extraction

To undo a parameter extraction, **left-click** on its name and select **Disconnect Parameter** from the popup menu. This will cancel the link between the extracted node and the original node, and the parameter will no longer be marked as connected.

Going to an extracted parameter

When a parameter is connected, it is possible to get quickly from the original node to the extracted node. **Left-click** on its name and select **Go To Parameter**. This will select the extracted node.

Alternative extraction method



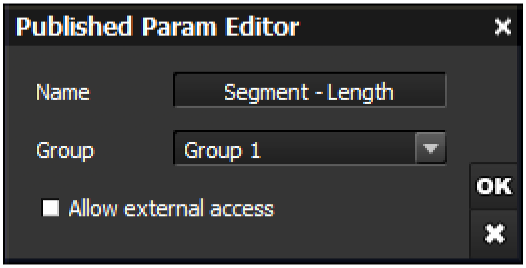
Extraction Alternative Method

There is another way to connect a parameter directly from the graph window. **Select** the node where you want to extract a parameter and **unfold** it using +, eventually unfolding the Additional parameters too. You see all the parameters with blue handles on the left. Create a graph of nodes and **link** it to the parameter you want to extract, this will do the job too.

Parameter Publication

Most parameters can be published. Publishing a parameter adds it to the Presets dialog. This is very handy to have the most important plant parameters gathered into one dialog.

To publish a parameter, **left-click** on the parameter name. The name shows as underlined. In the popup menu, select **Publish**.



Published Parameters Editor

In this editor, enter the **name** you want to assign to the published parameter. You may also enter a **group** name. This is useful when some published parameters must be grouped together in the Presets dialog.

Published parameters of a plant exported to VUE (CarbonSactter) can be edited directly in VUE (CarbonScatter) plant editor. To be available, a published parameters needs to have **Allow external access** activated.

After a parameter has been published, it is possible to unpublish it or edit its name or group. **Left-click** on the parameter name again and the corresponding menu entries will be displayed.

Section 6

Import and Export

Import

There are two options for import:

Import Mesh this opens a browse screen to find the mesh you wish to import. Import formats are:

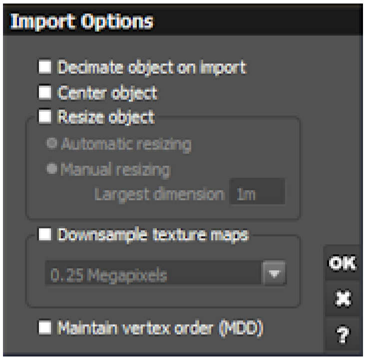
- **Vue Object (.vob):**
- **3D Studio (.3ds):**
- **and Wavefront (.obj):**

Click on the Import Objects button to display the Import Options dialog.

Import Component: this opens a Component Browser for you to find and select a component (.tpc).

Import Options

When you import an object from another application (File | Import Object from the menu), the Import Options dialog displays only if you click the Import Options button on the object select dialog. If you don't need to display this Import Options dialog, just select the object to import and continue.



Import Options

This simple dialog lets you configure the way the object will be imported:

- **Decimate object on import:** when this option is selected, the object will be automatically decimated in order to reduce its polygon count while preserving as much of its original geometry as possible

- **Center object:** when this option is selected, the imported object will appear at the center of the 3D Views, regardless of the object position stored in the imported file
- **Resize object:** when this option is selected, the imported object will be automatically resized according to the following options:
  - **Automatic:** the object is resized so that it fills up the viewports,
  - **Manual:** the object is resized according to the indicated resize factor

  If the resize option is unchecked, the object will be scaled according to the information stored in the imported file
- **Largest dimension:** When the Resize object and Manual resizing options are checked, the object is resized so that its largest dimension is equal to the entered value
- **Downsize texture maps:** Check this option to automatically downsize all texture maps associated with the object you are importing. Overly large texture maps use a lot of computer resources and this is a good way to ensure that all texture maps are a reasonable size. The dropbox allows you to select a size in megapixels for all of the texture maps.
- **Maintain vertex order (MDD):** used for import of MDD files

Export

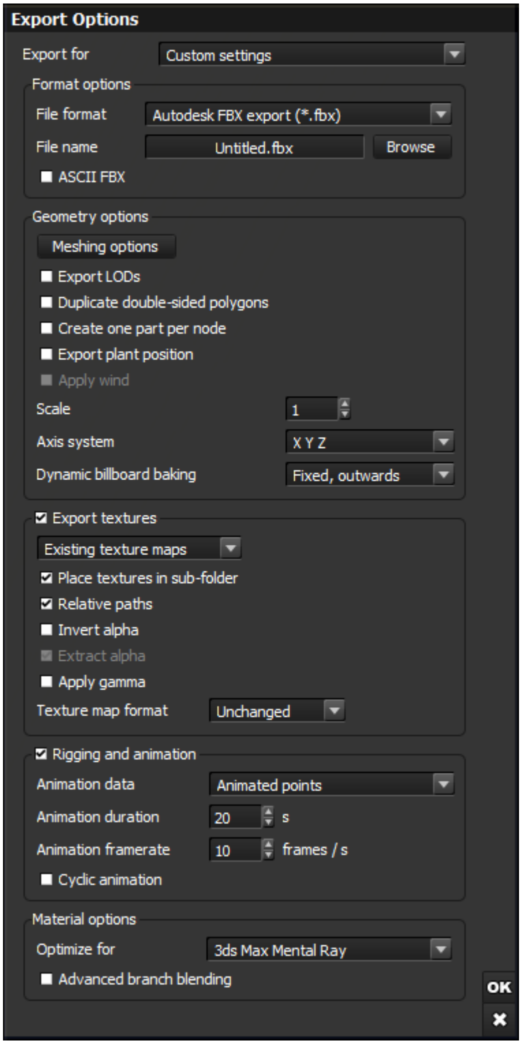
Plants created in PlantFactory can be exported in several formats.

- **Export as Mesh:** Export as an object for use in other softwares, such as 3DS Max or Maya.
- **Export to VUE:** Export for use in VUE.
- **Export to Carbon Scatter:** Export for use in Carbon Scatter.
- **Export to LumenRT:** Export for use in LumenRT.
- **Export for Cornucopia3D:** This exports the plant in a format for posting at cornucopia3d.com.
- **Share on Exchange Area:** This uploads the plant and shares it on CORNUCOPIA3D Exchange Area.
- **Send to a friend:** This uploads the plant and create a temporary link to send to a friend.
- **Create Component:** This exports plant or plant part for use in PlantFactory as a component.

Designer, Studio, Producer…

Generic Export

...Designer, Studio, Producer...



Generic Export Options

From the Export menu option, select **Export As Mesh**. This will export your plant as an object mesh.

Select your target 3D software/renderer from the **Export for** dropdown list at the top of the dialog to define best export options. You can find the specific instructions for exporting TPF plants into your 3d software here.

To manually set all the fields, select **Custom settings**.

...Designer, Studio, Producer

Format options

Designer, Studio, Producer

- **File format:**
  - **.3ds:** 3D Studio
  - **.c4d:** Cinema 4D v5 export
  - **.lwo:** LightWave export
  - **.obj:** Wavefront OBJ export
  - **.fbx:** Autodesk FBX export

Studio, Producer

-
  - **.abc:** Alembic v1.5 Ogawa and v1.0 HDF5 export
  - **.goz:** Pixologic ZBrush GoZ export

Designer, Studio, Producer

- **File name:** path of the export file
- **ASCII fbx:** FBX exports may be written in binary or ASCII format.

Geometry options

Designer, Studio, Producer

- **Meshing:**
- **Double-sided polygons:** Check for double-sided polygons.

Producer

- **Create one part per node:** Check to create separate nodes.

Designer, Studio, Producer...

- **Export plant position:** export plant position from the PlantFactory scene
- **Apply wind:** bake first frame wind deformation on the geometry
- **Scale:** enter the global scaling factor for the exported geometry.
- **Axis system:** select the coordinates system for your export.

…Designer, Studio, Producer

- **Dynamic billboard baking:** defines how to bake billboards dynamically facing camera for export. The possible choices are :
  - **Fixed, user-defined:** the billboard orientation depends only on the orientation parameters defined in its parent primitive instance.
  - **Fixed, facing current camera:** the position of the current camera is used to bake the orientation of the billboard.
  - **Fixed, outwards:** the billboard is always parallel to the plant vertical axis.
  - **Fixed, facing X axis:** the billboard is facing the X axis.

Designer, Studio, Producer…

Export Textures

Existing texture maps

Exports textures extracted from the plant materials

- **Place textures in sub-folder:** places exported texture maps in sub-folder “Maps” of export folder.
- **Relative paths:** check to use relative paths for texture maps.
- **Invert alpha:** check to invert the alpha.
- **Embed alpha:** check to embed the alpha into the color texture.
- **Texture map format:** There are several options for the texture map: unchanged, BMP, JPG, PNG, TGA, or TIF.

Per polygon maps (Ptex)

Ptex Export Options

Exports the plant material as a **Ptex** texture: draw a small texture for each polygon.

- **Resolution:** The slider sets the number of pixel per unit. A higher pixel per unit gives an export with a better resolution.
- **Color channel:** export the color channel of the material
- **Alpha channel:** export the alpha channel of the material
- **Bump channel:** export the bump channel of the material
- **Normal channel:** export the normal channel of the material

...Designer, Studio, Producer

Rigging and animation

Studio, Producer

Only C4D, LWO and FBX formats give you the option of exporting rigging and animation. These options do not display for other format exports.

- **Animation data:** there are three options:
  - **Static Bones:** bones but no animation
  - **Animated Bones:** bones and animation
  - **Animated Points:** points and animation
- **Animation duration:** length of the animation in seconds
- **Animation framerate:** frames per second
- **Cyclic animation:** Forces the baked animation to be cyclic

Material options

Producer

- **Optimize for:** select your target 3D software/renderer from the list.
- **Advanced branch blending:** check to export material blending.

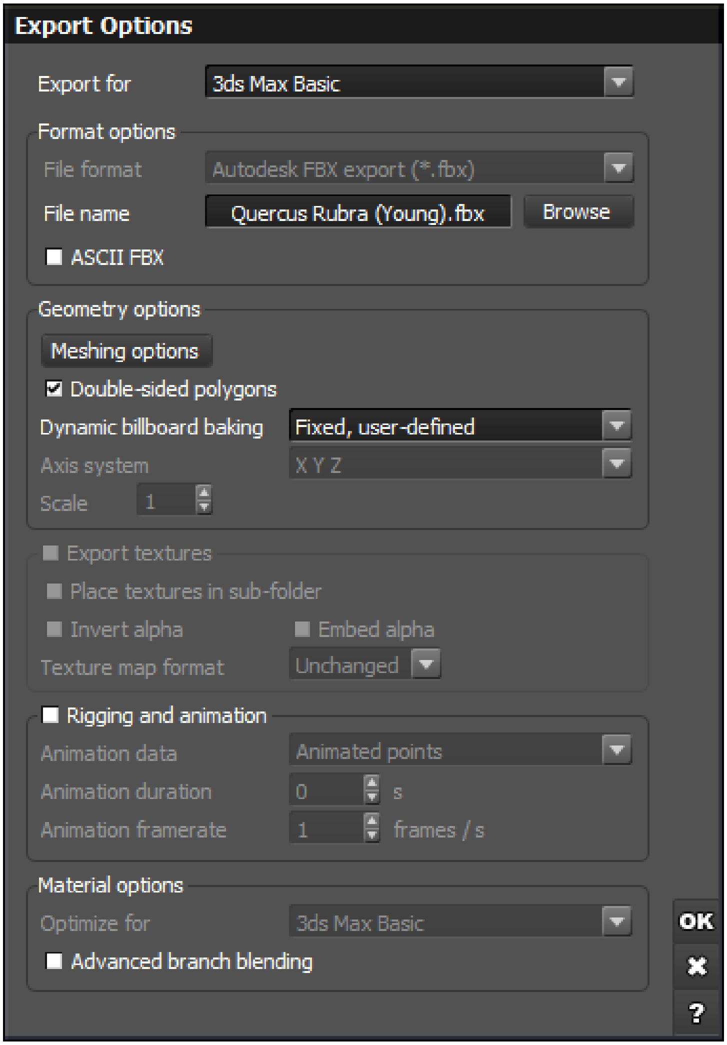
Export to Products

Designer, Studio, Producer

Export to 3dsMax

Designer, Studio, Producer...

From the generic export dialog:



Export to 3dsMax

...Designer, Studio, Producer...

- depending on the renderer you want to use, select **Export for 3dsMax Basic**, **Export for 3dsMax MentalRay** or **Export for 3dsMax VRay**
- set the export filename. .FBX is the available file format.
- set the other export options according to your needs
- click **OK**

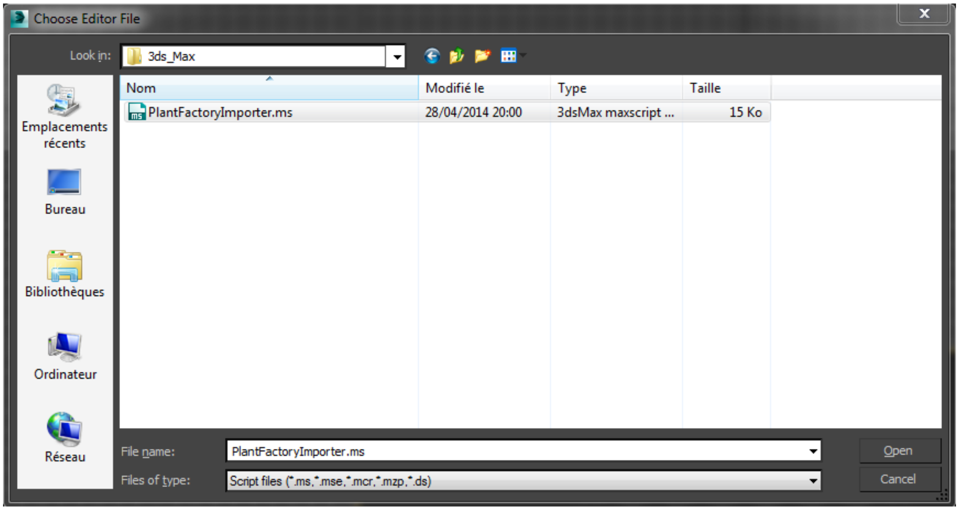
PlantFactory provides users with an import script to enrich plant import in 3dsMax, with a particular focus on branch material blending and native material translation. The script is located inside the Plant Factory installation : **Scripts / 3ds_Max / PlantFactoryImporters.ms**. It was developed for the 2014 and 2015 versions of Max; compatibility with previous versions is possible but not guaranteed.

...Designer, Studio, Producer...

Please note that, according to the terms of the EULA, if you would like to provide content to a client in .FBX format, you are allowed to give them a copy of these import scripts together with the .FBX files to make it easier for them to import your content.

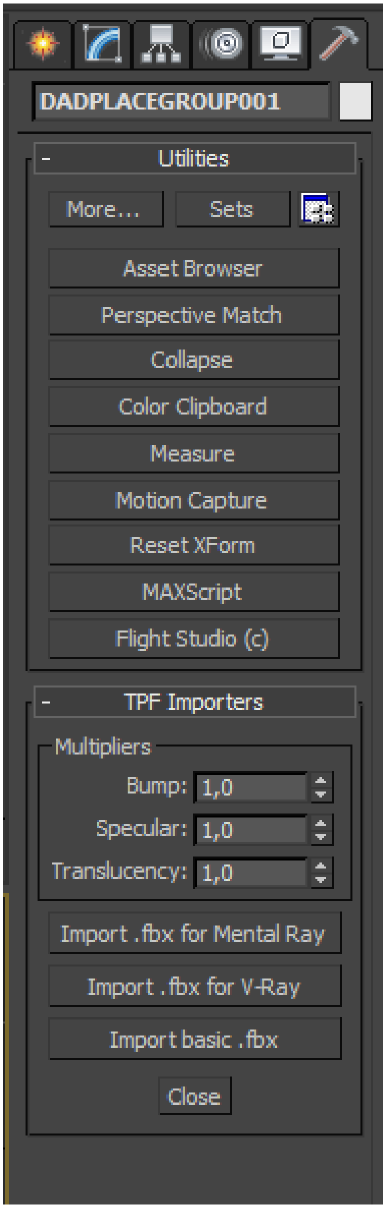
To import your export file into 3dsMax

- Start 3dsMax.
- Click on the **MAXScript** menu and then select **Run Script**.
- Browse to the *Scripts/3ds_Max* folder in your Plant Factory installation folder.



Script browser

- Select **PlantFactoryImporters.ms**.
- This makes a **TPF Importers** panel appear inside the **Utilities** tab.



...Designer, Studio, Producer...

TPF Importers panel

- The Multipliers fields allow you to tweak **bump**, **specular** and **translucency** values of the plant materials. Though the default value of 1 should yield decent results, it is always possible to perform some fine tuning with these entry fields. **Be sure to adjust them accordingly before importing the plant as their values cannot be modified after import.** In case you realize the values you set are not fully satisfying you can always delete the imported plant from the 3dsMax scene and restart the import process with better parameters.

...Designer, Studio, Producer

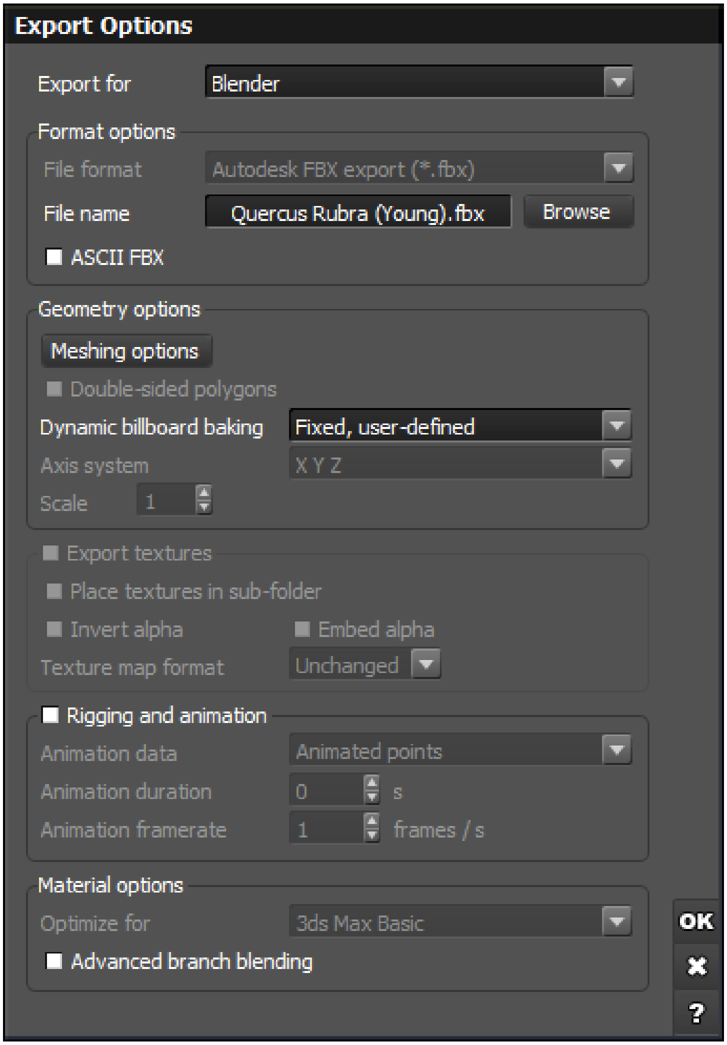
- You get to choose for which renderer you would like to import the FBX plant : **Mental Ray**, **V-Ray** or the **default scanline renderer** of 3DS Max (Import basic .fbx). Take care to select the right import mode since you then need to use the renderer that matches your choice in the **Rendering / Render Setup / Common** dialog.
- A file browser opens after you hit one of the **Import** buttons. Browse to the FBX plant file you generated with Plant Factory and click **Open**.
- The **Close** button makes the TPF Importers panel disappear. It can still be called back later by using the **MAXScript** / **Run Script** menus as described above.

Export to Blender

Designer, Studio, Pro- ducer...

From the generic export dialog:

...Designer, Studio, Producer...



Export to Blender

- select **Export for Blender**
- set the export filename. .FBX is the available file format.
- set the other export options according to your needs
- click **OK**

In Blender :

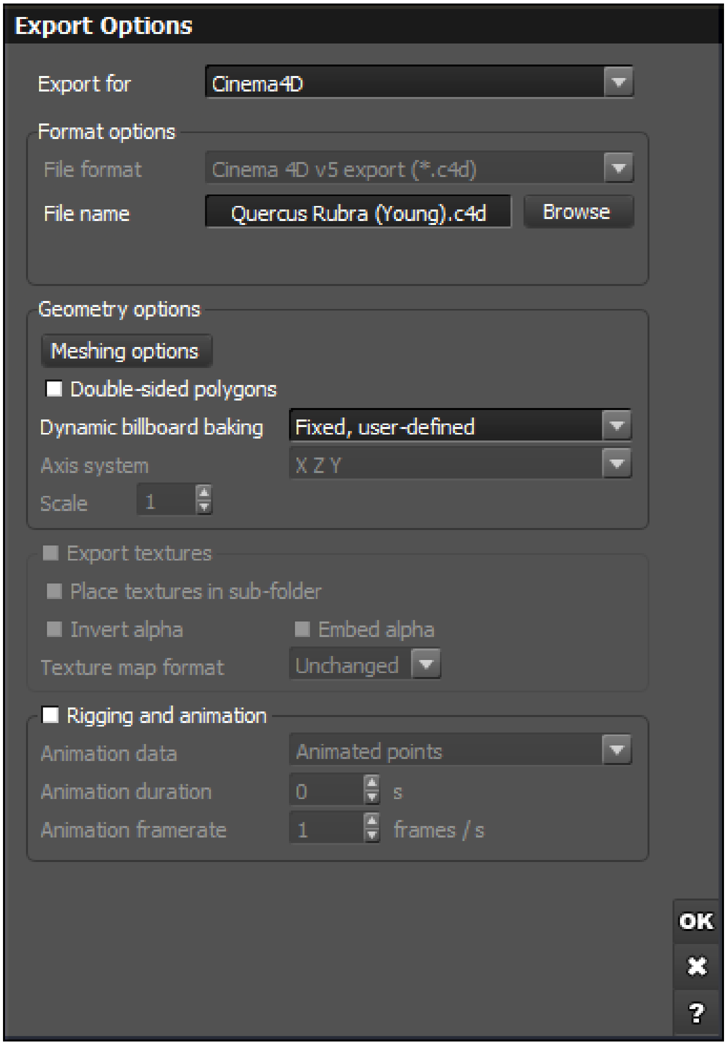
- use the **Import** function from the **File** menu and select the **Autodesk FBX (.fbx)** option
- browse to the file Plant Factory created
- click **OK**
- Alpha maps are not imported correctly by Blender, so you should uncheck **Use Alpha** on the alpha channel of each material of the imported object.

…Designer, Studio, Producer

Export to Cinema4d

Designer, Studio, Producer…

From the generic export dialog:



Export to Cinema4d

...Designer, Studio, Producer...

- select **Export for Cinema4D**
- set the export filename. .C4D is the available file format.
- set the other export options according to your needs
- click **OK**

In Cinema4D :

- use the **Open** or **Merge** functions from the **File** menu
- browse to the file Plant Factory created
- click **OK**

…Designer, Studio, Producer

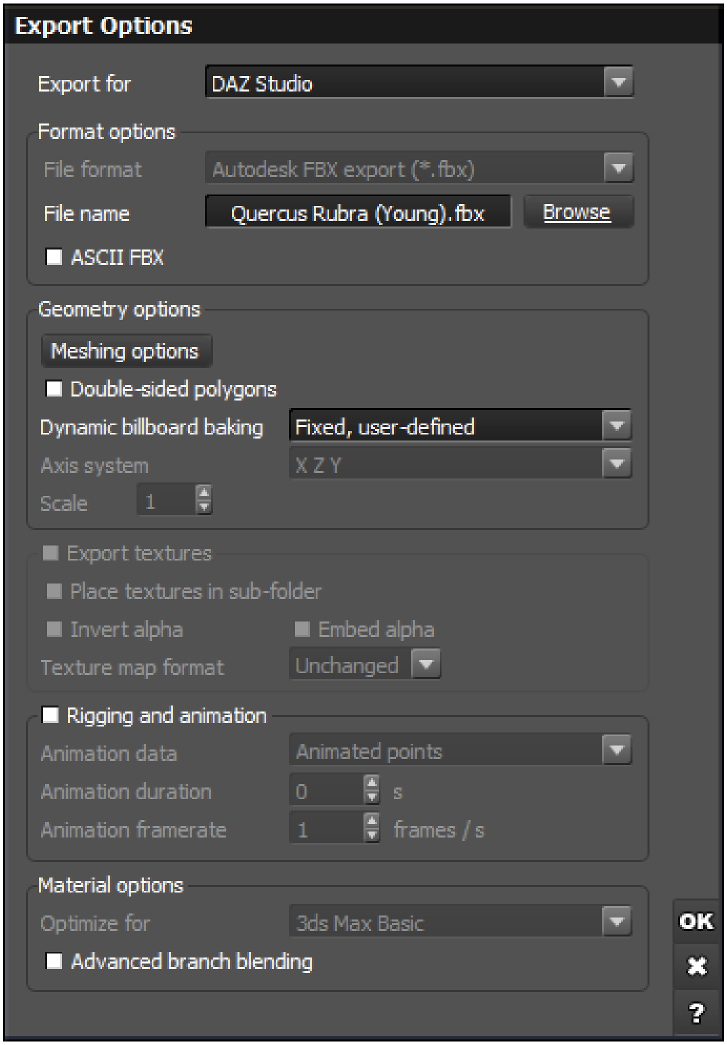
Alternatively, you can drag and drop the file from a browser.

Export to DAZ Studio

Designer, Studio, Producer…

From the generic export dialog:

...Designer, Studio, Producer...



Export to DAZ Studio

- select **Export for DAZ Studio**
- set the export filename. .FBX is the available file format.
- set the other export options according to your needs
- click **OK**

In DAZ Studio :

- use the **Import** function from the **File** menu
- browse to the file Plant Factory created
- click **OK** to close the browser
- click **OK** to close the rigging warning

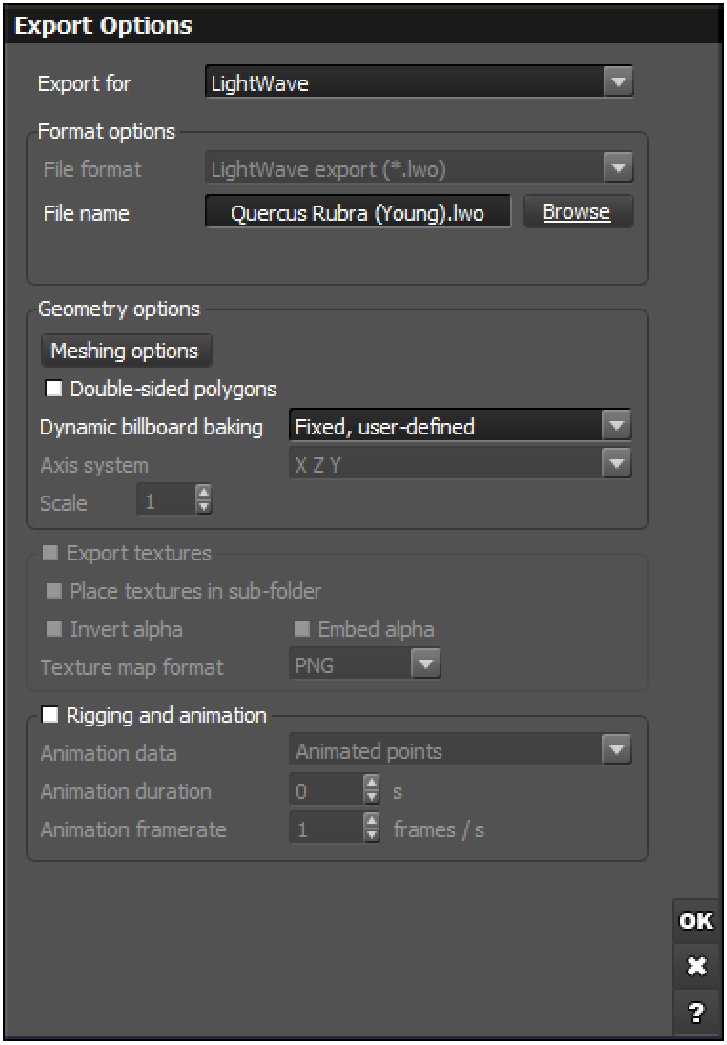
...Designer, Studio, Producer

Export to LightWave

Designer, Studio, Producer...

From the generic export dialog:

...Designer, Studio, Producer...



Export to LightWave

- select **Export for LightWave**
- set the export filename. .LWO is the available file format.
- set the other export options according to your needs
- click **OK**

In LightWave Layout, for an object without animation:

- use the **Load** function from the **File** menu, and select **Load Object...**
- browse to the LWO file Plant Factory created
- click **OK**

...Designer, Studio, Producer

Alternatively, you can drag and drop the file from a browser.

In LightWave Layout, for an animated object :

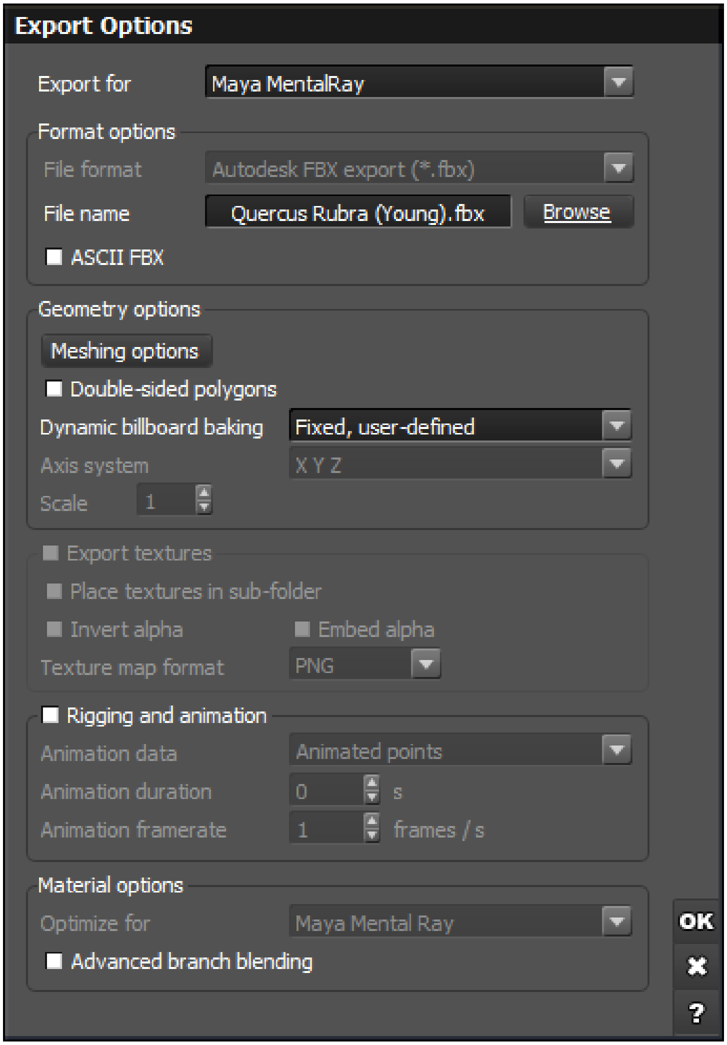
- use the **Load** function from the **File** menu, and select **Load Items From Scene...**
- browse to the LWS file Plant Factory created
- click **OK** to close the browser
- click **OK** in the Load From Scene dialog

Export to Maya

Designer, Studio, Producer...

From the generic export dialog:

...Designer, Studio, Producer...



Export to Maya

- depending on the renderer you want to use, select **Export for Maya MentalRay** or **Export for Maya VRay**
- set the export filename, .FBX is the available file format.
- set the other export options according to your needs
- click **OK**

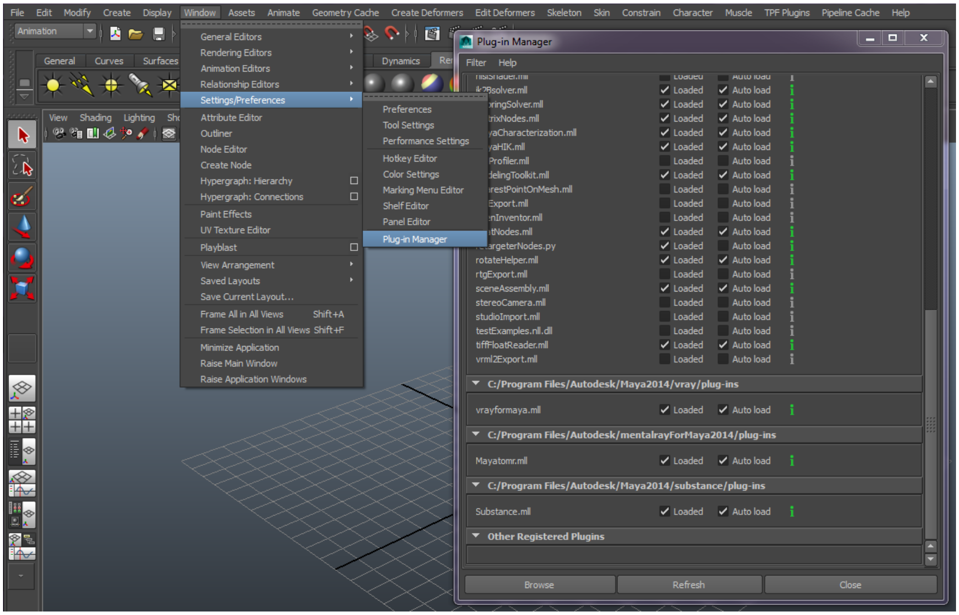
…Designer, Studio, Producer…

PlantFactory provides users with import scripts to enrich plant import in Maya, with a particular focus on branch material blending and native material translation. The script is located inside the Plant Factory installation folder : **Scripts / Maya / PlantFactoryImporters.py**. It was developed for the 2014 and 2015 versions of Maya; compatibility with previous versions is possible but not guaranteed.

Please note that, according to the terms of the EULA, if you would like to provide content to a client in .FBX format, you are allowed to give them a copy of these import scripts together with the .FBX files to make it easier for them to import your content.

To import your export file in Maya:

- Start Maya.
- In Maya, the TPF importers are considered as a plugin. Click on the **Window** menu and then browse to **Settings / Preferences** and **Plug-in Manager**

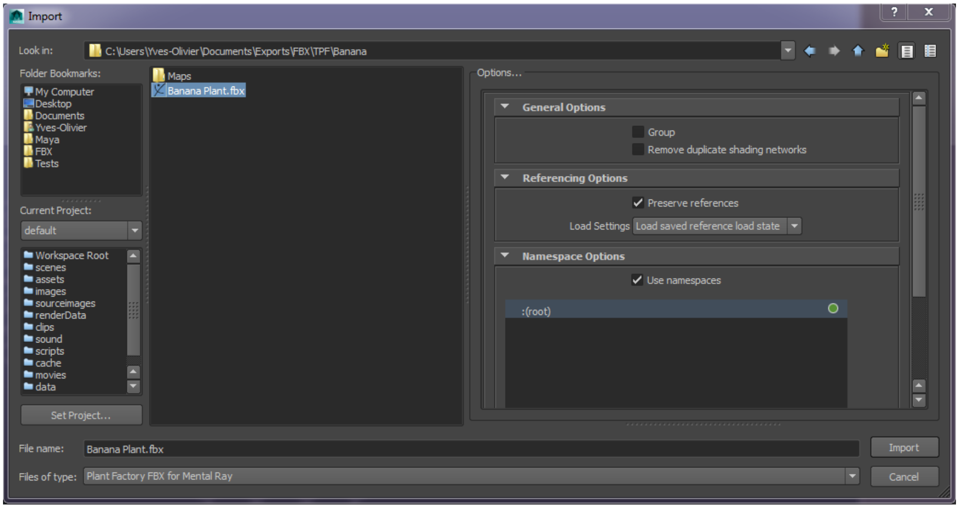


Plug-in manager

- This opens the Maya plug-in manager and will allow us to register the TPF importers into the Maya plug-in list. Click on **Browse** and browse to the *Scripts/Maya* folder in your Plant Factory installation folder.
- Select **PlantFactoryImporter.py** and click **Open**.

...Designer, Studio, Producer...

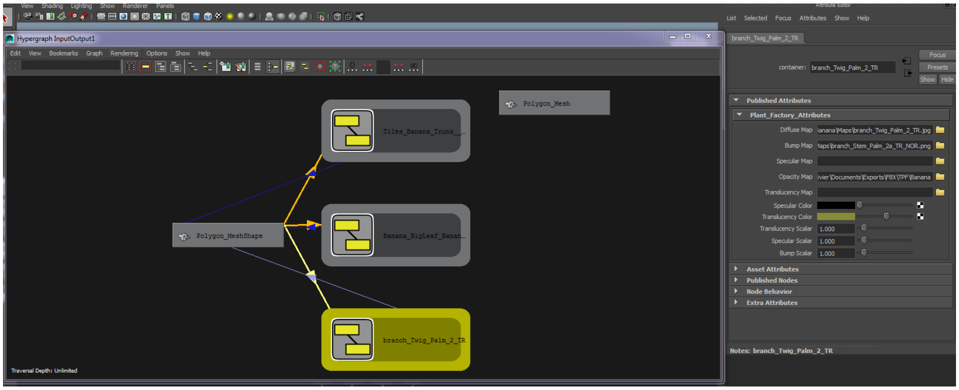
- **PlantFactoryImporter.py** should now be registered in the plug-in list under the **Other Registered Plugins** category.
- **Close** the Plug-in Manager.
- Click on the **File** menu and select **Import...**.



Import

- This opens a file browser. In the bottom a drop-down menu allows you to select the source file format. The TPF importers add two more options to this list:
  - **Plant Factory FBX for Mental Ray**
  - **Plant Factory FBX for V-Ray**
- Pick your choice according to the renderer you will be using. (In Maya the renderer can be selected from a drop-down menu inside the Render view that appears after you click one of the Render buttons).
- Browse to the FBX plant file you generated with Plant Factory and click **Import**. The imported plant should now appear in Maya.
- The TPF importers for Maya allow some advanced material tuning after import. To adjust material properties, access the **Plant__Factory__Attributes** of the chosen material, for example by opening the **Hypergraph** through the **Window / Hypergraph: Connections** menu items.

...Designer, Studio, Producer



Material nodes

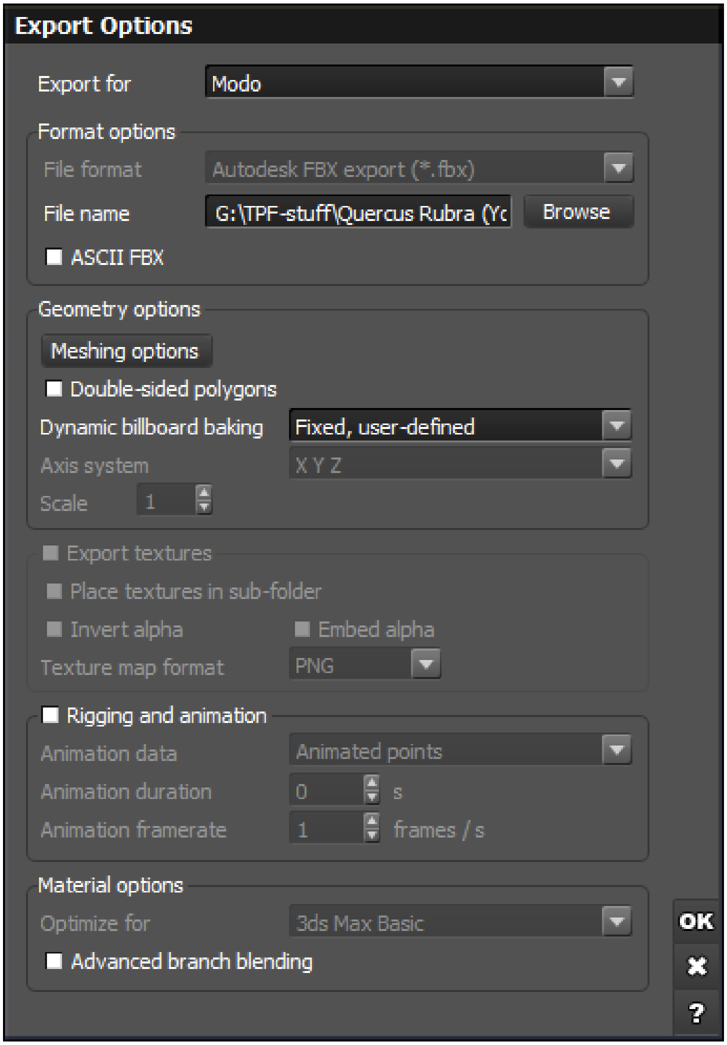
- The **Plant__Factory__Attributes** are made of several tweakable parameters that can be dynamically adjusted (the map paths are better not modified):
  - the **Specular (highlight)** reflexion and **Translucency (backlight)** colors
  - **Translucency**, **Specular** and **Bump** scalar multipliers. Setting them to their default 1 value should yield satisfying results, but you can always tweak them if you care.

Export to Modo

Designer, Studio, Producer...

From the generic export dialog:

...Designer, Studio, Producer...



Export to Modo

- select **Export for Modo**
- set the export filename. .FBX is the available file format.
- set the other export options according to your needs
- click **OK**

In Modo :

- use the **Import** function from the **File** menu
- browse to the FBX file Plant Factory created
- click **OK** to close the browser
- click **OK** to validate the FBX load options

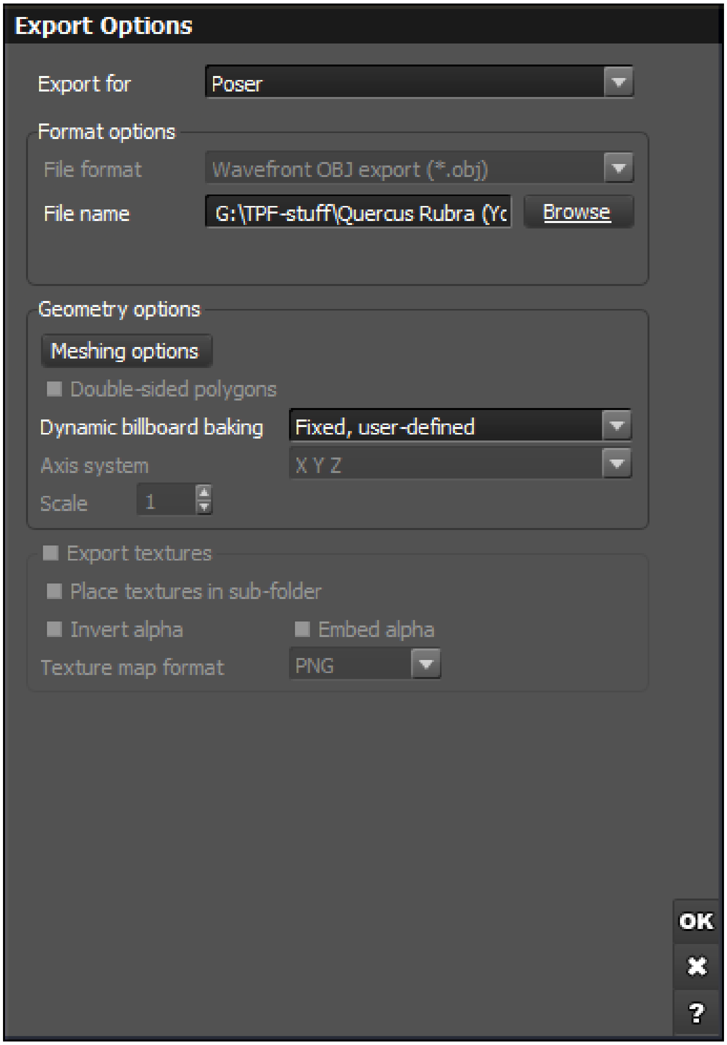
Alternatively, you can drag and drop the file from a browser.

...Designer, Studio, Producer

Export to Poser

Designer, Studio, Producer...

From the generic export dialog:



Export to Poser

...Designer, Studio, Producer...

- select **Export for Poser**
- set the export filename. .OBJ is the available file format.
- set the other export options according to your needs
- click **OK**

In Poser :

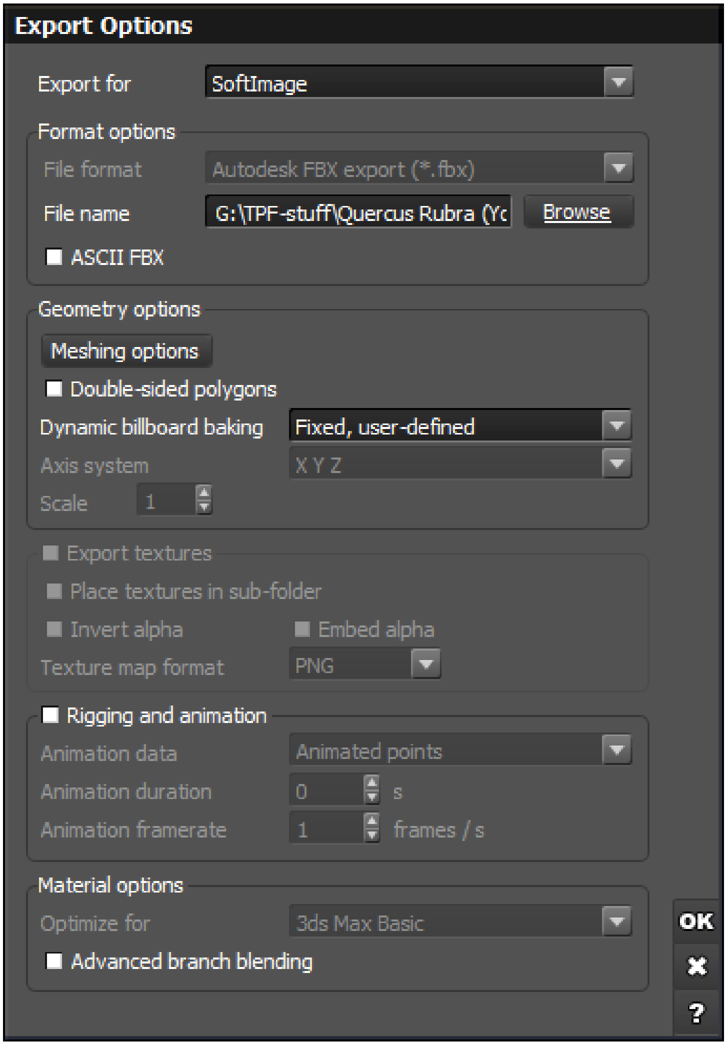
- use the **Import** functions from the **File** menu and select **Wavefront OBJ...**
- click **OK** to validate the import options
- browse to the file Plant Factory created
- click **OK**
- since Poser doesn't import alpha maps correctly you may want to fix them. Go to the Material tab and click on the Transparency frame in order to define a transparency map.

...Designer, Studio, Producer

Export to SoftImage

Designer, Studio, Producer...

From the generic export dialog:



Export to SoftImage

- select **Export for SoftImage**
- set the export filename. .FBX is the available file format.
- set the other export options according to your needs
- click **OK**

In SoftImage :

- use the **Import** function from the **File** menu and select **Import FBX...**
- browse to the file Plant Factory created
- click **OK**
- click **OK** to close the Crosswalk FBX Import dialog

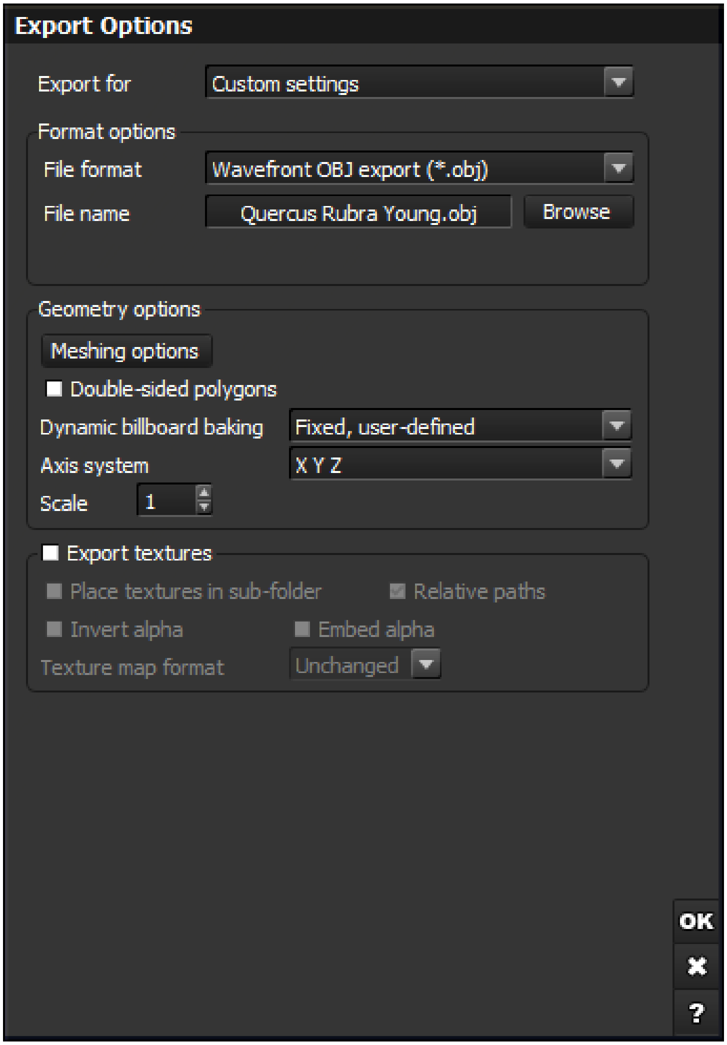
...Designer, Studio, Producer

Export to Terragen

Designer, Studio, Producer...

From the generic export dialog:

...Designer, Studio, Producer...



Export to Terragen

- select **Custom settings**
- select **Wavefront OBJ**
- set the export filename.
- set the other export options according to your needs
- click **OK**

In Terragen :

...Designer, Studio, Producer

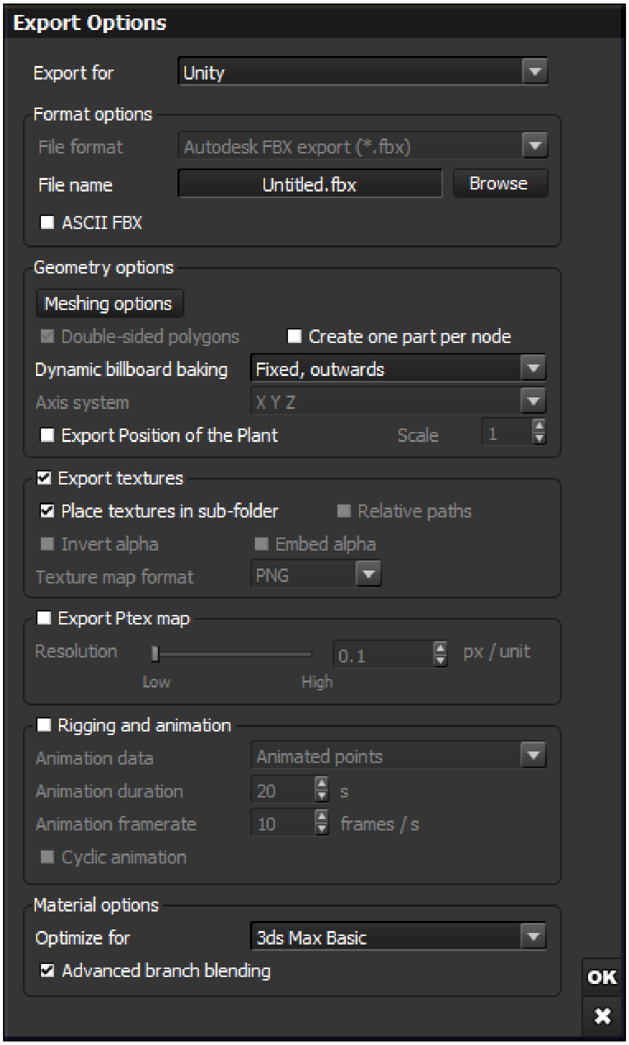
- use the **Import Object** function from the **File** menu and select **Wavefront OBJ (.obj)**
- browse to the file Plant Factory created
- click **OK**
- if Terragen asks whether the object is from Xfrog, answer **No**

Export to Unity 5

Designer, Studio, Producer...

From the generic export dialog:

...Designer, Studio, Producer...



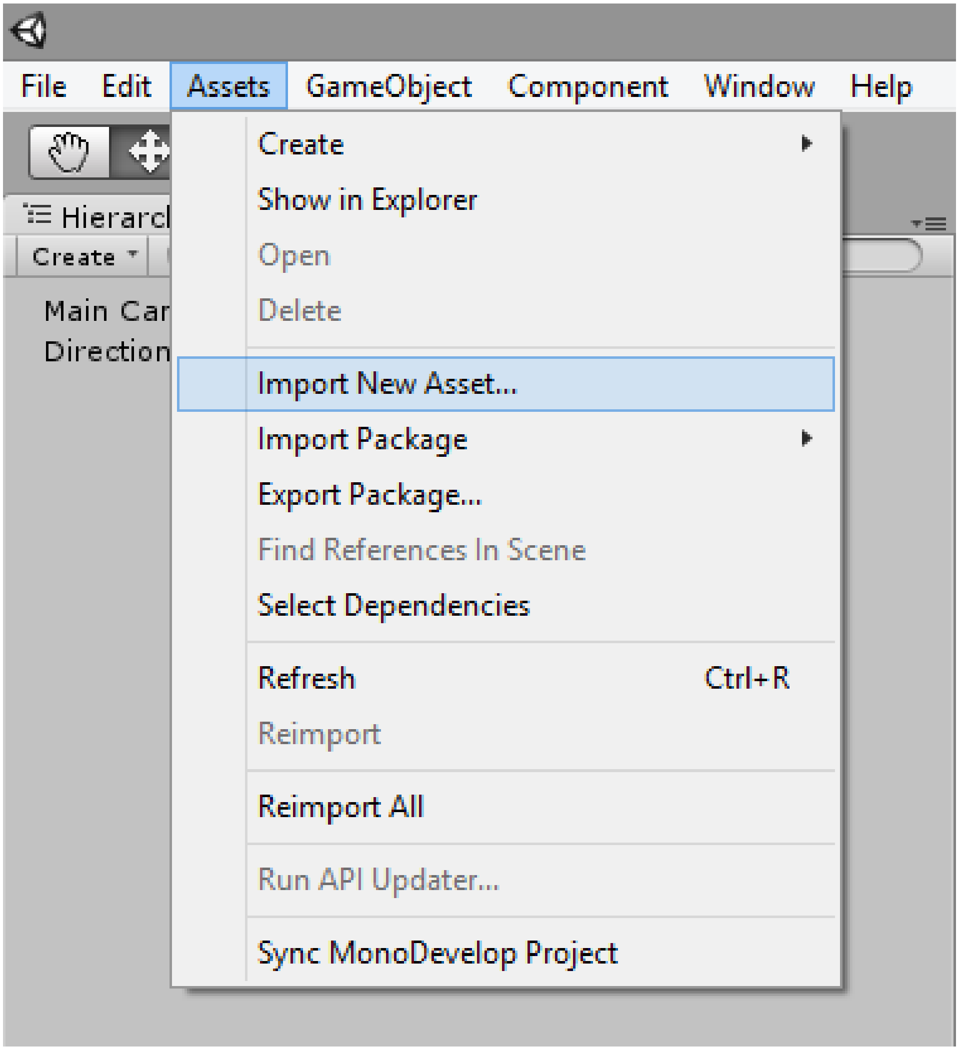
Export to Unity 5

- Select **Export for Unity**
- set the other export options according to your needs
- click **OK**

To import your export file into Unity

...Designer, Studio, Producer...

- Start Unity.
- Click on the **Import New Asset...** in Assets.



Import New Asset

- Browse to the *Objects* folder in your Plant Factory folder and select your fbx file.
- Now you can put your new asset in the scene.
- Then you can load the materials exported with the plant from the **Maps** folder.

- You have now your plant or tree as a model in Unity.

For a better outcome in Unity we advise you to chose the standard Unity's shader when important the fbx file in Unity, as shown below :

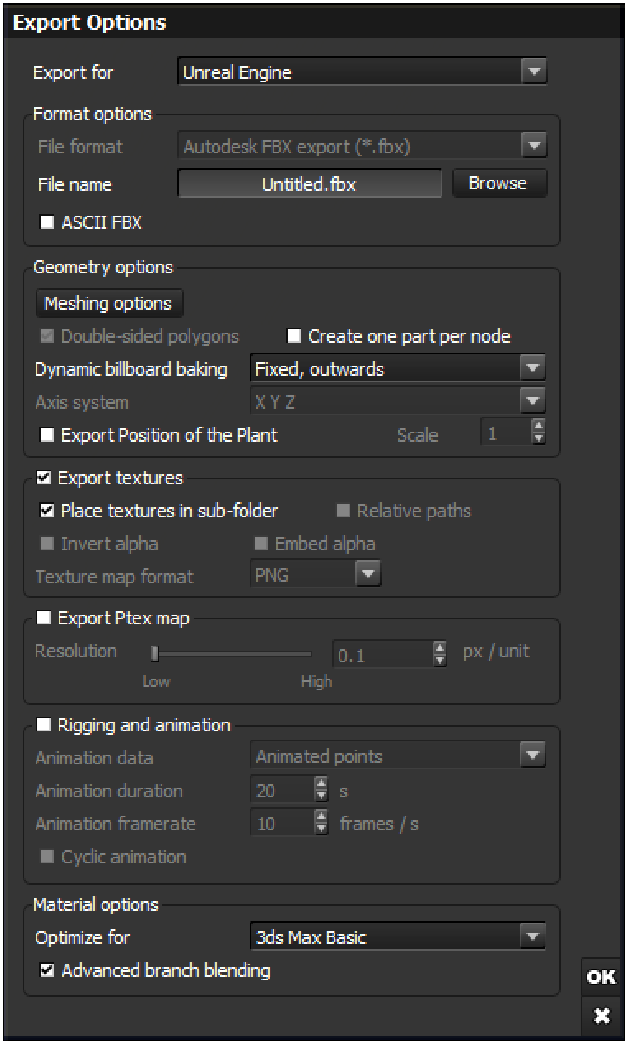
Setting Unity's default shader for the imported plant.

...Designer, Studio, Producer

Export to Unreal Engine

Designer, Studio, Producer...

From the generic export dialog:



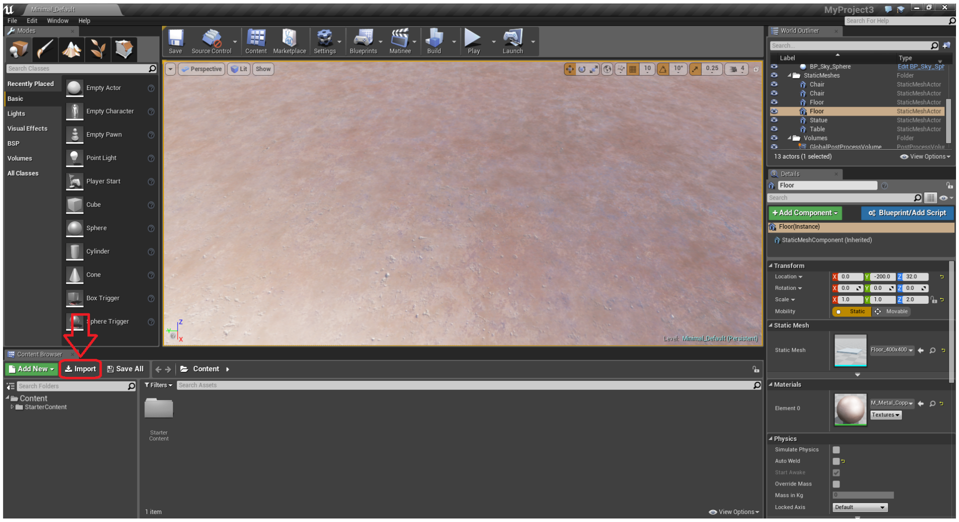
Export to Unreal Engine

- Select **Export for Unreal Engine**
- set the other export options according to your needs
- click **OK**

To import your export file into Unity

…Designer, Studio, Producer…

- Start Unreal Engine.
- Click on the **Import** button in the **Content Browser**.



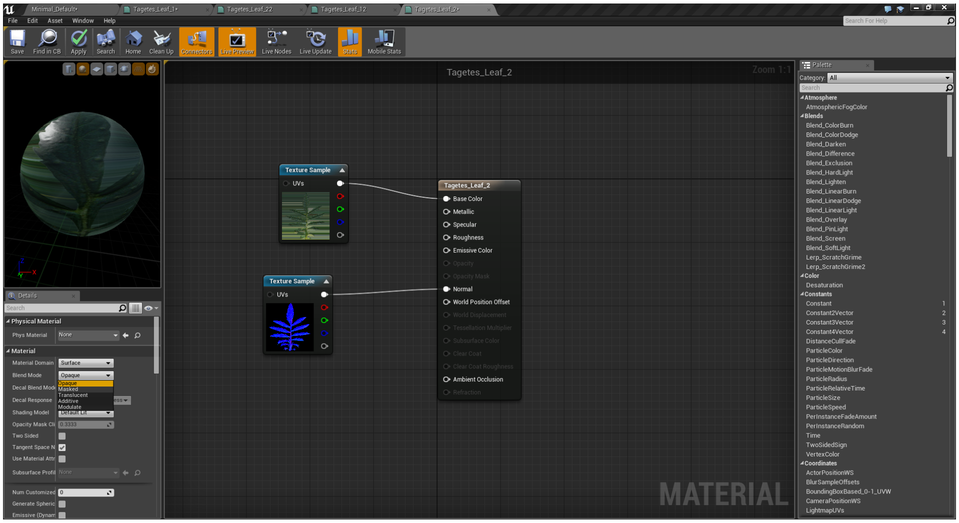
Import New Component

- Browse to the *Objects* folder in your Plant Factory folder and select your fbx file, it should load the mesh with all the textures if you chose to import with the materials and textures.
- Now you can put your new object in the scene.
- You have now your plant or tree as a model in Unreal Engine.

It may happen that some alpha's textures are not showing correctly. Follow these steps to correct the issue:

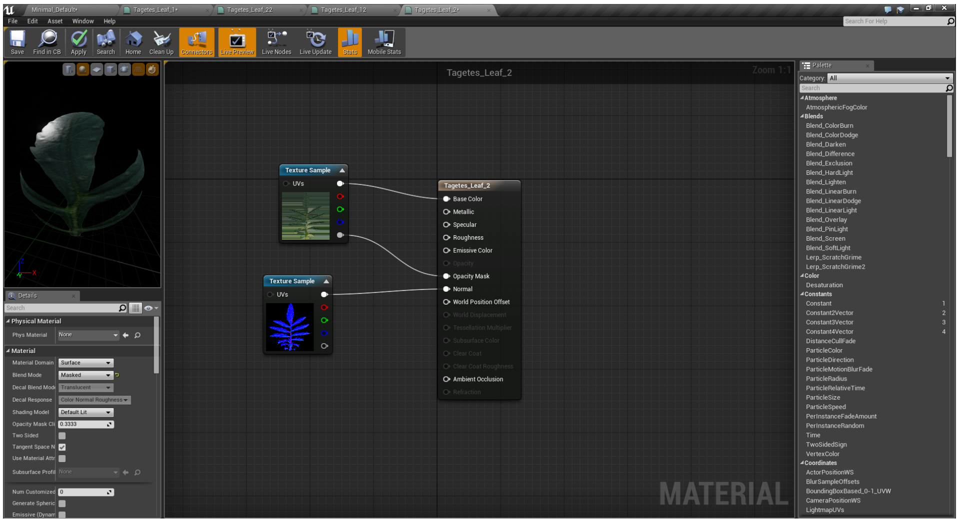
- Double click on the material, it will open the material's editor.
- In the **Details** of the material change the **Blend Mode** to **Masked**.

…Designer, Studio, Producer…



Material's editor

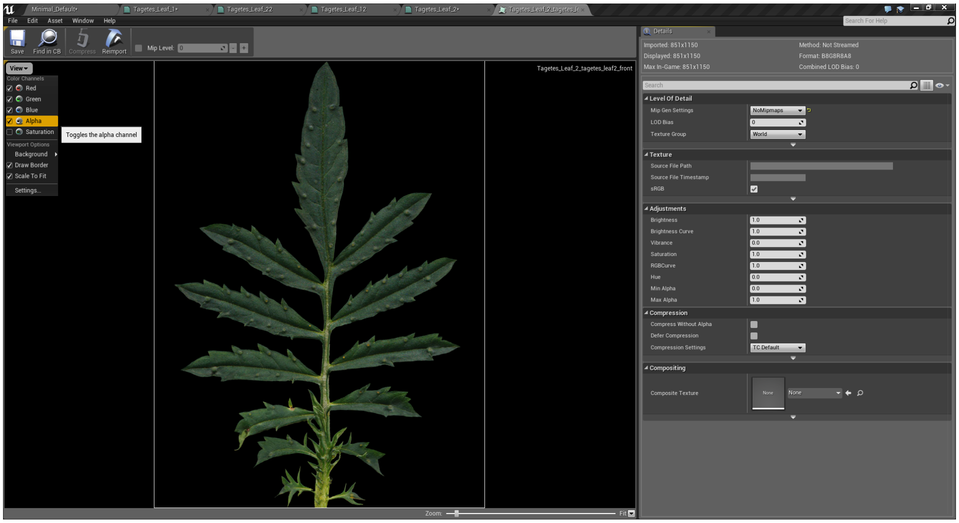
- Connect the alpha channel of the **Texture Sample** to the **Opacity Mask** input.



***Connecting the alpha channel to the** Opacity Mask*

- If the material doesn't have alpha, click on Texture Sample **and double click on the material's image. It will open the texture's editor.**

…Designer, Studio, Producer



Texture's editor

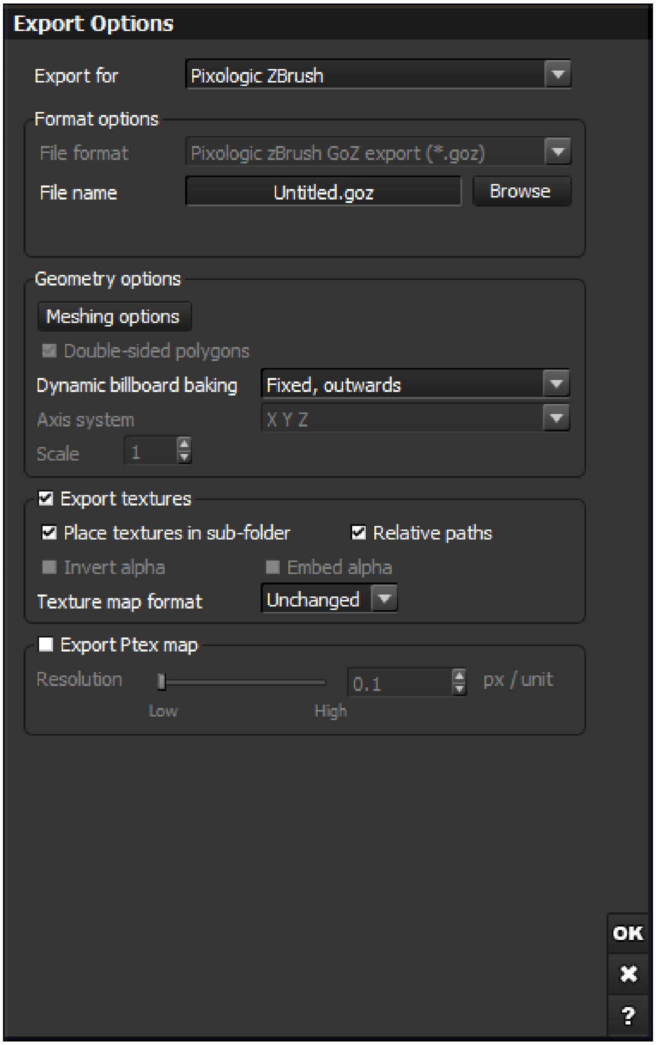
- Now the material should show the alpha correctly.

Export to ZBrush

Designer, Studio, Producer…

From the generic export dialog:

...Designer, Studio, Producer...



Export to ZBrush

- Select **Export for Pixologic ZBrush**
- set the other export options according to your needs
- click **OK**

To import your export file into ZBrush

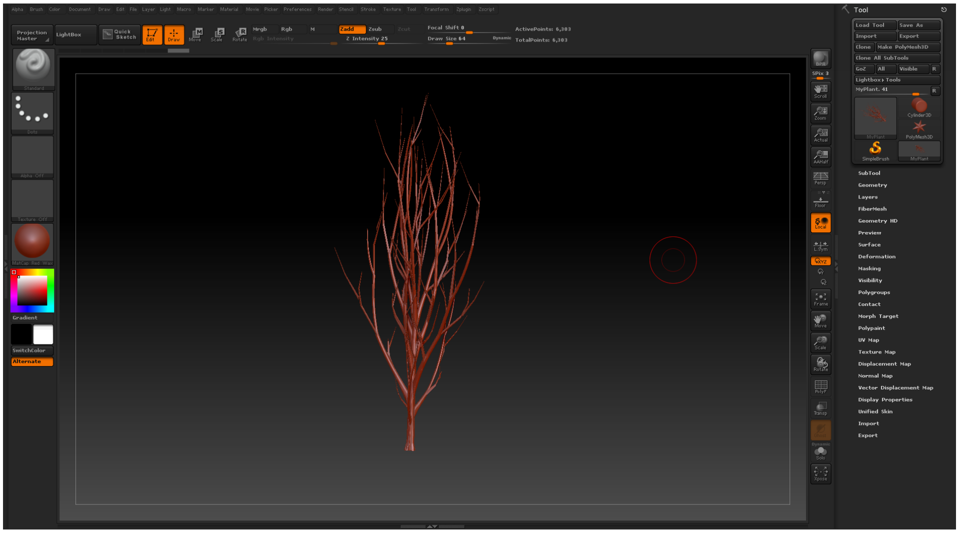
- Start ZBrush.
- Click on the **Import** button in the top right corner.

Import button

- Browse to the *Objects* folder in your Plant Factory folder.
- Select your GoZ file.
- You have now your plant or tree as a model in ZBrush

...Designer, Studio, Producer...

…Designer, Studio, Producer



TPF Importers panel

Export To VUE

PlantFactory can export a plant to VUE in various formats.

Export VUE Species (.tpf)

The most powerful format is the VUE Plant Species. The main advantage of the VUE Species is that it will enclose all the functional logic of your plant, including randomization parameters, and the logic created in the function graph. This allows you to use the power of the VUE EcoSystem to have VUE generate unique plant instances in your scene in VUE. For general purpose usage, this would be the recommended format.

Export VUE Object (.vob)

You can also export your plant as a static model in VUE Object format (VOB). The object will contain an exact replica of your plant in static form, without any additional randomization or other intelligence. This can often be helpful when you do not anticipate changes to the model, and do no plan on having more than a single instance of the model, such as a Hero Tree scenario.

Export VUE 2015 Mesh (.vob)

This option bakes the plant into a mesh then exports it in VUE Object format (VOB). This can be helpful to optimize rendering of your plant but you will not take advantage of TPF rendering technology.

Export VUE 2014 Mesh (.vob)

This option is similar as Export VUE 2015 Mesh but exported file will be comaptible with VUE 2014.

Export VUE Presets (.tpf)

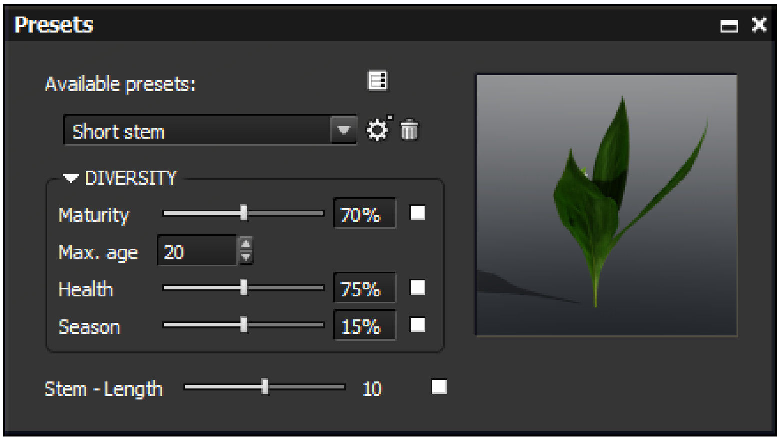
This option is similar as Export VUE Species but will create as many files as presets in your plant (see Export Presets).

Restrictions

Please note, the End User License Agreement for PlantFactory contains certain restriction on the distribution and sale of exported objects.

Export Presets

The information found on the Presets Tab can can be exported as “preset” TPF file. The data includes any presets created with published parameters and the age, season, and health parameters.



Published Parameters Presets

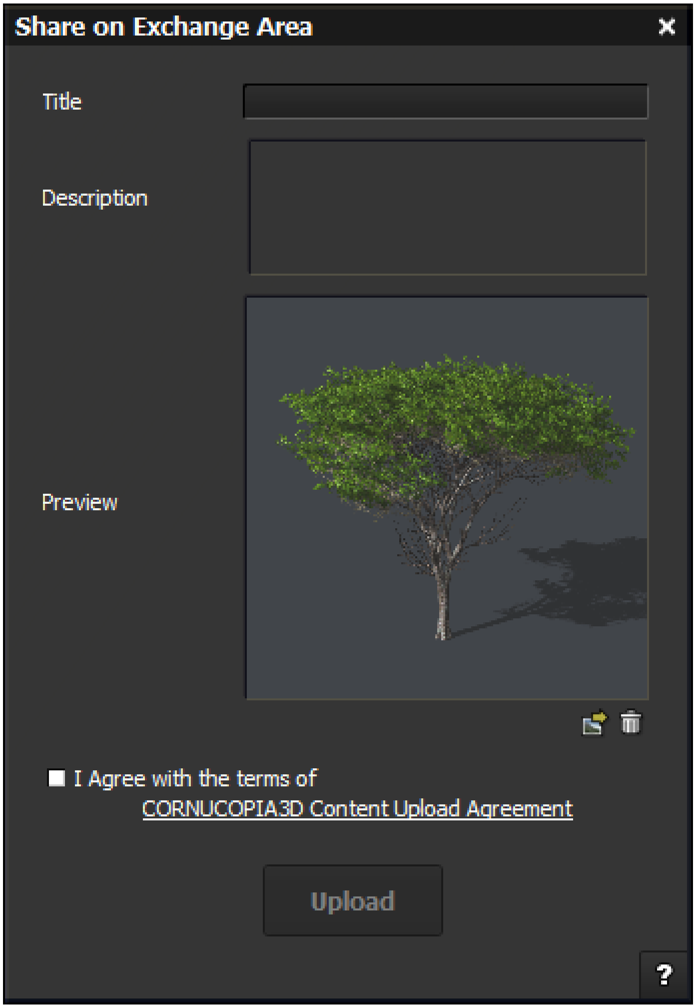
These exported preset files only contain preset data and a link to a “real” tpf file (“main” file), containing all plants info (graph, material,...)

This feature can be used to create many plant variations from a single plant without duplicating the TPF file, conserving resources, which makes this very useful for brokers to easily create a bundle of plants for Cornucopia.

Note:

these preset files need to be sold as bundle with the main file.

Share on Exchange Area



Share on Exchange Area

From the Export menu option, select **Share on Exchange Area**. This will upload and share your plant on CORNUCOPIA3D Exchange Area

- **Title:** title of your item on CORNUCOPIA3D
- **Description:** description of your item on CORNUCOPIA3D
- **Preview:** preview of your item on CORNUCOPIA3D. By default, a screen shot of

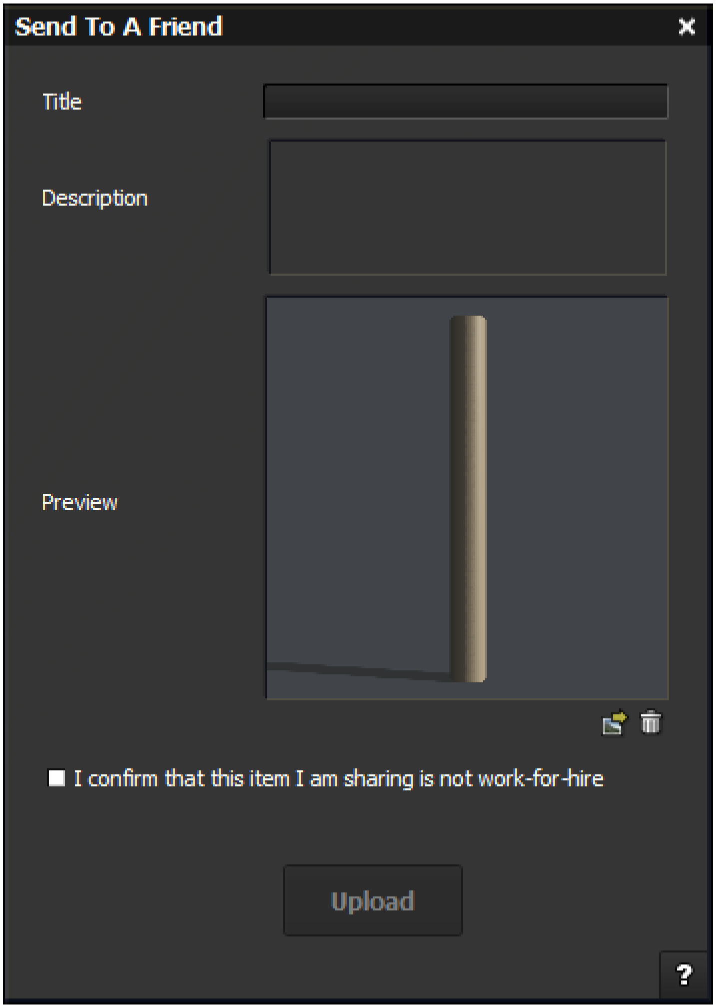
the 3D preview.

You can choose a custom image:

  - **Load:** choose a picture to set as preview
  - **Remove:** remove the custom picture and set back the 3D preview picture.

- **I Agree:** you need to read and accept the temps of CORNUCOPIA3D Content Upload Agreement
- **Upload:** Upload and share your item on CORNUCOPIA3D Exchange Area.

Send To A Friend



Send To A Friend

From the Export menu option, select **Send To A Friend**. This will upload your plant on CORNUCOPIA3D and create a temporary url so that your friend can download it. The uploaded plant can only be downloaded once.

- **Title:** title of your item on CORNUCOPIA3D
- **Description:** description of your item on CORNUCOPIA3D

- **Preview:** preview of your item on CORNUCOPIA3D. By default, a screen shot of the 3D preview.

  You can choose a custom image:
  - **Load:** choose a picture to set as preview
  - **Remove:** remove the custom picture and set back the 3D preview picture.
- **Upload:** Upload on CORNUCOPIA3D and create the temporary url.

Export To CS

PlantFactory can export a plant to Carbon Scatter if PlantFactory and Carbon Scatter are linked together (see Link with other e-on Products).

Restrictions

Please note, the End User License Agreement for PlantFactory contains certain restriction on the distribution and sale of exported objects.

Export To LRT

PlantFactory can export a plant to LumenRT if PlantFactory and LumenRT are linked together (see Link with other e-on Products).

Restrictions

Please note, the End User License Agreement for PlantFactory contains certain restriction on the distribution and sale of exported objects.

Export For C3D

PlantFactory can export a plant to TPF Cornucopia3D format (.tpfc3d).

This special export file format is designed for uploading plants to the Cornucopia3D marketplace.

Once uploaded, a plant can be sold or shared with any TPF or Vue users.

When exporting as C3D item, if the plant contains presets, every preset will be automatically saved as a preset file for Cornucopia (.tpfc3d).

A preset file is an empty TPF file which contains only a link to a “real” TPF file (“main” file) and a preset of this tpf plant.

So, when a preset file is loaded, the software looks for the referenced tpf file, loads this file, and applies the preset defined in the preset file.

This mechanism allows to create multiple variation of a plant without saving the whole plant every time. It is very useful to create a bundle based on a single plant graph.

Since “preset” file information (title, description, preview) are filled automatically and are necessary to submit on Cornucopia, make sure this information are correct in every presets before exporting.

This information can not be changed except by making the whole export again.

For more information, see Brokering at Cornucopia3D.

Section 7
Rendering

Rendering gives you a 2D representation of your 3D object. The options available in PlantFactory allow you to select the quality of the render and make changes to it post-render. And your renders can be saved.

You can select the options for your render in the Render Options dialog. Since Producer has more options for rendering, it has a different Render Option dialog than the other products. Designer, Studio and Artist versions have their own Render Options dialog.

Studio, Designer and Artist Render Options

Producer Render Options

In Producer, you can render animation as well using the Render Animation dialog.

Producer

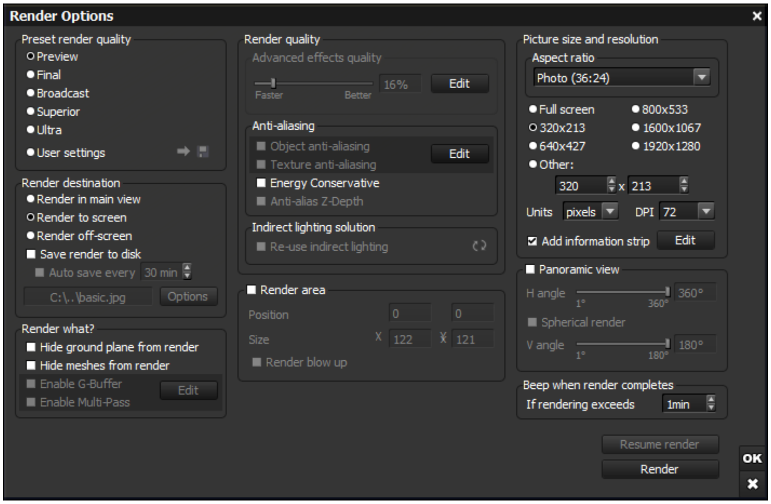
Producer also gives you the option of changing the background atmosphere and lighting. The *Atmosphere Editor* is available to give you all of the controls you should need to create atmospheres using spectral lighting, global radiosity lighting, clouds, and low light situations to list just a few options.

After rendering, you can tweak your rendering in the Post Render Options dialog.

Render Options -- Producer

Overview

Producer



Render Options Dialog (Pro version)

Click on the Render icon on the Render toolbar to start rendering a picture of your plant.

The Render settings have been slightly adjusted to increase the anti-aliasing threshold and to add a bit of texture filtering which will improve overall render quality. This is available from Broadcast quality on up. It may increase render times slightly, however.

The Render icon is a double action icon. If you right-click the icon, the **Render Options** dialog will pop-up.

Preset Render Quality

Producer...

- **Preview:** this is the default setting whenever you create a new scene. It is a good working balance between picture quality and render speed. It traces reflections, transparency and cast shadows correctly, although it only mocks-up advanced features like soft shadows, blurred reflections / transparency and depth of field. The last render pass is optimized for speed, and the picture is not anti-aliased. We recommend you stick to this mode while you work on the picture, and only switch to Final settings when you have finished brushing up your scene.

...Producer

- **Final:** as indicated by the name, this setting produces the final picture. It handles all features correctly, including advanced features such as soft shadows, and applies are reasonable quality anti-aliasing pass. Render times, however, are several times longer than in Preview setting. We recommend rendering pictures in this setting only when they are finished.
- **Broadcast:** this render setting was introduced for animation purposes. Basically, it adds motion blurring to the Final preset quality. However, it also features improved anti-aliasing quality, representing the optimal settings (in terms of render quality vs. render time) for rendering animations. Whenever the scene exhibits depth of field or motion blur, single pass Hybrid 2.5D technology will be used.
- **Superior:** this render setting is similar to Broadcast, with adjustments made to improve quality. Rendering with this setting is done in 5 Hybrid 2.5D technology passes and is significantly slower than in Broadcast.
- **Ultra:** this is the best render quality available. It is also not very useful, since it takes several times longer to render than other settings, while not necessarily producing outstandingly better results. Use it only when you want to render very high quality pictures, at a not too high resolution. High DPI pictures for publishing usually render just as well in Final quality setting. Ultra setting adds superior anti-aliasing and improved advanced effects rendering.
- **User:** the last setting is not a preset one. It grants you full access to customize as you like the render engine, by selecting only the options you want from the render option checkboxes and anti-aliasing settings. These options will be detailed further down. The default User settings correspond to a faster version of Final render (with less super-sampling involved).
- **Load, Save:** When you select the User render quality setting, two small buttons on the right hand side of this option become available. These buttons allow you to load or save your user settings. Pressing one of these buttons will display a Standard File Browser letting you load or save the selected file. The User Render Settings configuration files are stored in the Environment folder of the program files, and use the .URS extension. Files are supplied for all default preset render settings (Preview, Broadcast...). That way you can base your own user settings on an existing preset. You should avoid modifying any of these files.

Render Destination

Producer...

This lets you decide whether you want the picture to be rendered inside the main camera 3D view (the picture resolution will be that of the 3D view), if the picture should be rendered into a stand alone window, or if the picture should be rendered to disk.

- **Render in main view:** the picture will be rendered in the Main view, and the size of the picture will be that of the view.
- **Render to screen:** rendering will be done in a separate window that will appear when you start rendering (you will have to indicate the resolution of the picture). You can also save both the depth channel and the alpha channel renders when the render has finished. Previous renders are also displayed with the Render to screen option. Renders are stacked; this means that they are saved and can be used for comparison or further editing (with Post Render Options). These are displayed along with the current render. For more information about this feature, refer to the Render Display dialog.
- **Render off screen:** selecting this option instructs the render engine to save the picture as it renders, and not to display it. Saving pictures as they render is useful if you want to render pictures much larger than your screen. Selecting this option activates the **Options** button. Pressing it displays the **Render to Disk dialog**, letting you indicate which channels of information should be saved and the name of the file that they will be saved in. If the file already exists, TPF will ask for confirmation before starting the render.
- **Save render to disk:** This option is automatically checked if you select the Render off-screen option. But it can also be checked if you are rendering to screen or the main view. This automatically saves your render to disk as well as allows you to save after your screen render has finished. Press the **Options** button to indicate which channels of information should be saved and the name of the file and format to save it to.
- Additionally, you have the option of an **Auto save** every of of your render at a preset interval. You can set the interval in minutes for the auto save. You might want to do this so that you don't lose the entire render if your computer loses power (for example). You should be aware that auto saving does slow the render process down a bit, so it's probably not something you would want to do frequently.

...Producer

Render What?

Producer

- **Hide Ground Plane from Render:** this option won't render the ground plane.
- **Hide meshes from render:** this option won't render any meshes.
- **G-Buffer / Multi-Pass Options:** In Final or better preset render quality, select the **Enable G-Buffer / Multi-Pass** option to activate the collection of G-Buffer and Multi-Pass information. Click the Edit button to open the G-Buffer Multi-Pass Options dialog and select the channels of information / rendering components / masks that you need. For more information, refer to G-Buffer Multi-Pass Options.

Render Quality

Producer

- **Advanced effects quality:** this setting controls the overall quality of all the advanced rendering effects in the scene (e.g. volumetric lights, global illumination, procedural terrain, soft shadows,displacement mapping, etc.). The Edit button is accessible for all preset render modes, in order toget access to the Optimize indirect lighting on plants option. Of course, when not in User mode, only this option will be available, all the others (custom GI & photon map settings) will be grayed out.If you find that all the advanced rendering effects are rendered with artifacts (noise, splotches…), you can reduce these artifacts either by boosting the quality of each effect independently, or by increasing the quality globally using this slider.

Click the Edit button to open the Advanced Effects Options dialog and gain advanced control over the rendering process.

Anti-Aliasing

Producer…

Anti-aliasing options are automatically adjusted in the various preset render settings (see above). In the User render setting, however, you can control anti-aliasing options manually.

In addition to the standard Object anti-aliasing, TPF offers the possibility to use Texture antialiasing, for both bitmap and procedural textures.

- **Object anti-aliasing:** takes care of aliasing in the geometry. Check this option to enable this form of anti-aliasing (see page 225 for details).
- **Texture anti-aliasing:** takes care of aliasing in the textures. Check this option to enable this form of anti-aliasing.
  The object and texture anti-aliasing are adjusted using the Anti-Aliasing Options dialog. This dialog is accessed by clicking the Edit button.

Energy Conservative: This preserves bright details while limiting the amount of anti-aliasing needed to get a smooth rendered picture. Enabling this option is recommended whenever the rendered picture contains very small bright details like narrow specular highlights or sun reflections over a perturbed water surface, especially in photometric lighting mode, which produces very high intensity variations between shadowed and lit areas.

- **Anti-alias Z-Depth:** Check this option to enable this form of anti-aliasing. Object anti-aliasing also needs to be enabled to access this feature, since depth anti-aliasing is perfomed in the same way as for color and alpha channels for consistency. Note: Depth anti-aliasing can produce undesirable effects depending on how z-depth information is used. When this option is disabled, TPF records the closest hit element distance within each rendered pixel. When enabled, all hit distances are averaged. This can lead to a resulting distance that doesn't correspond to any actually hit geometry. *…Producer*

Indirect Lighting Solution

Producer

When the **Re-use indirect lighting** box is selected, the radiosity calculation will not be performed again at the time of rendering. Instead, the last calculation will be re-used, and any subsequent lighting information gathered from further renderings will be added, appending new indirect lighting data to it at each new render, whenever needed.

This is especially useful for walk-through animations, where the camera progressively discovers new parts of a scene while moving throught it. Indeed, illumination caching will just compute any missing information at each frame, while reusing previous calculations wherever possible, significantly reducing render times while also reducing flickering artifacts.

Obviously, if the lighting conditions have changed, or if significant changes have been made to the scene, the radiosity calculation may no longer be accurate. To update the calculation, press the Update Indirect Lighting Next Time icon. This will update the indirect lighting the next time you render so that it matches any changes made to the scene.

Render Area

Producer…

This option lets you select a rectangular area in the picture outside of which the picture won't be rendered. You can also select a render area using the main menu command Render | Select Render Area and then drawing the render area with the mouse.

When you select this option, the render area controls become available:

- **Position:** these two settings let you define the top-left corner of the area to be rendered (in pixels).
- **Size:** these two settings indicate the width and height of the render area (in pixels).
- **Render blow-up:** this option is only available when rendering to screen or to disk. When it is selected, the render area will be rendered at the size of the picture

indicated in the Picture size and resolution group. If it is not selected, the picture will be rendered at the exact size indicated. This option is useful when you want to render a close-up of a detail in your picture.

...Producer

This render area can be locked by using the **Lock Render Area** option on the contextual menu. This will protect the selected area from mouse movements, allowing you to keep the setting while still working on the scene.

Picture Size and Resolution

Producer...

You can choose the format of your picture by picking a pre-defined Aspect-ratio from the dropdown list. If no pre-defined aspect-ratio is suitable, select Free (user defined) and then type the size of your picture in the two Other boxes.

A set of 6 boxes below the aspect-ratio list lets you select standard picture resolutions. Alternately, you can enter any other resolution using the two boxes in the group called Other. If you have selected a pre-defined aspect-ratio, the vertical and horizontal resolutions of your picture will be linked together. These boxes are only available if you are rendering the picture to screen, since, if you render inside the main 3D View, the resolution of the picture is defined by that of the view. Selecting Full screen guarantees the biggest possible resolution that fits inside your current display.

Once you change the aspect ratio, you may notice two gray stripes in the main view. They are here to show you the limits of the picture in the selected format, and help you optimize framing.

The **Units** drop-down list lets you select the units you want to work with. If you are planning to print the picture, you probably will want to switch to inches or centimeters. In this case, the DPI (Dots Per Inch) box becomes active, and you can enter the required DPI setting for the generated picture.

- **DPI *(Dots Per Inch)*:** indicate the number of pixels per inch in the picture once it is printed on paper (i.e. the definition of the picture). What you need to understand is that the only way to increase the number of DPI of a picture without reducing its size on paper, is to increase its resolution. It is of general acceptance that, for professional work, 300 DPI is a good compromise between definition of the printed picture, and size of the render. 240 DPI is probably enough for standard use. Select the required number of DPI for your picture (usual values are in the drop-down list but you can enter any value). The default is 72 DPI, which is the definition for screen viewing. Changing DPI without changing the resolution of the image has no effect on the screen display size or quality of the finished image. The

DPI setting is only made available as a convenience for those wishing to print.

…Producer

- **Locking User Defined Aspect Ratio:** If you select Free (user defined) as an aspect ratio, and enter a picture size in the Other (size)field, you have the option of locking this ratio. If you later change the width, the height will change automatically preserving that aspect ratio.

Add Information Strip

Producer

This is an information strip that displays at the bottom of an image rendered to screen or in any of the viewports. It can display a combination of the scene name, frame number, render time, image resolution and poly count. Select which items to display by clicking on the Edit button on the right.

When rendering to screen, the information strip can be toggled on or off.

If you wish to save this information, you have two options when saving the render. On the Save As dialog, you have the option of adding this strip to the image itself, or you can save it into a log file. This log file can be found in your render destination directory with the name imagename.log.

Panoramic View

Producer…

This option is available only when **Render to screen** or **Render to disk** is selected.

Real panoramic cameras are fixed to a handle that you have to hold when you take the shot. As it takes the shot, the camera rotates around the handle, thus embracing any required angle of view. Panoramic views can yield beautiful results.

This option is a numerical equivalent to the real panoramic camera. Here also, the camera is rotated as the render engine makes progress. All-around panoramas can be achieved this way, but beware: if the camera is not perfectly horizontal when you take the shot, the horizon will undulate. This is not a numerical artifact: it happens also in the real world!

When you select this option, the panoramic **H Angle** slider becomes available, letting you decide on the horizontal angle swept by the camera as it rotates.

The **Spherical render** option also becomes available when you activate Panoramic rendering. When you select this option, the scene will be rendered on a sphere (instead of being rendered on a cylinder). You can adjust the vertical angle swept by the camera using the **V Angle** setting. Spherical renders can be used, for example, for the rendering of an environment map. When this option is activated, the picture's aspect ratio is determined by the ratio of horizontal vs. vertical angles. *...Producer*

Closing the Dialog

Producer

Click **OK** to accept the changes and close the dialog. Click **Cancel** to cancel the changes.

To accept the changes and render the picture with the new settings, click the **Render** button.

If you have interrupted a render in progress, the **Resume render** button will be active. Click on this button to resume rendering the picture.

Note:

Any changes to the render quality will make resuming a render impossible.

Advanced Effects Options

Producer

This dialog offers you in-depth control over the rendering of advanced effects, such as the computation of indirect lighting as well as the processing of volumetric lights.

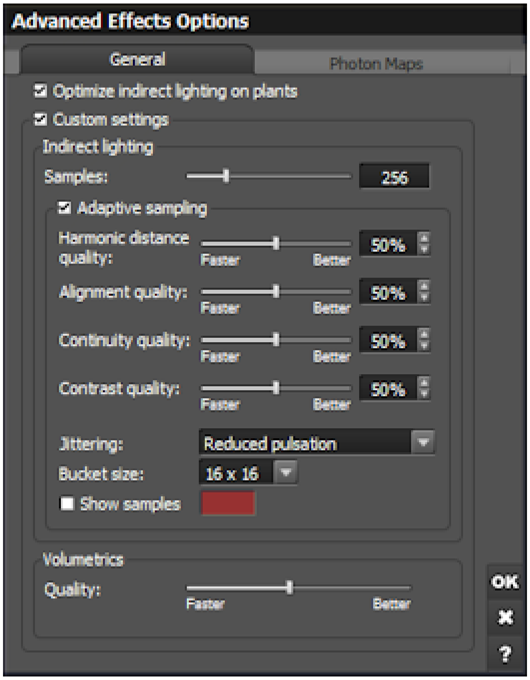
There are two tabs in this dialog:

- **General:** this tab takes care of general global illumination settings as well as the rendering of volumetric effects.
- **Photon Maps:** this tab grants you in-depth control over the way photon maps are generated and used.

Producer...

General Tab

...Producer...



Advanced Effects Options – General Tab

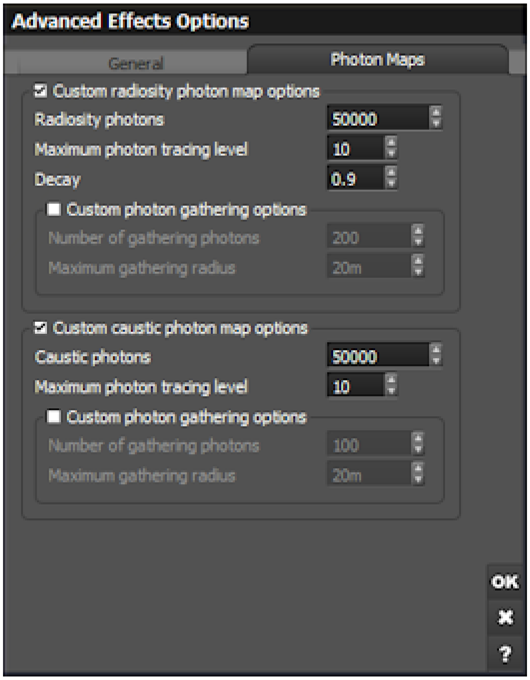
- **Optimize indirect lighting on plants:** because of the intricate complexity of the geometry of typical plants, evaluation of indirect lighting on plants can be very slow. If you select this option, the processing of indirect lighting on the plants will be greatly simplified. As a result, the evaluation will be slightly less accurate, but also a lot faster. The results produced by the optimized evaluation are usually sufficient for rendering indirect lighting on plants. However, if you want perfectly accurate indirect lighting on your plants, you will need to deselect this option. The controls in the **Custom Indirect Lighting settings** let you fine tune the way indirect lighting is evaluated in your scene. If you enable the **Custom settings** checkbox, the settings in this frame will override the EasyGI™ "Advanced Effects Quality" setting of the **Render Options** dialog.
- **Samples:** this setting controls the typical number of illumination samples that are processed to evaluate indirect lighting at each point in the scene.
- **Adaptive sampling:** when this option is checked, TPF uses a number of complex criteria to evaluate the frequency and accuracy at which the indirect lighting must

be evaluated. If this option is disabled, the indirect lighting will be recomputed entirely at each sample. This will result in incredibly long render times and it is strongly advised that you do not disable adaptive sampling. *...Producer*

- **Harmonic distance quality:** this setting controls the way TPF evaluates the distance to the objects in the vicinity of a point in the image, and the way this distance influences the evaluation of the indirect lighting.
- **Alignment quality:** this setting controls the way TPF evaluates the alignment of the different lighting samples in space, and the way this alignment influences the evaluation of the indirect lighting.
- **Continuity quality:** this setting controls the way TPF evaluates the orientation of the different lighting samples in space, and the way this orientation influences the evaluation of the indirect lighting.
- **Contrast quality:** this setting controls the way TPF evaluates the contrast between the different sources of lighting and materials, and the way this contrast influences the evaluation of the indirect lighting.
- **Jittering:** this drop-down list controls the way the lighting samples are distributed in space. There are two options in the list:
  - **Reduced pulsation:** when this option is selected (the default), the samples are distributed in such a way as to reduce the low frequency pulsation that is typical of animation using adaptively sampled indirect lighting. This option is particularly useful when creating animations. If you are creating stills, the second option may be of interest.
  - **Standard:** this option ensures a better statistical distribution of lighting samples throughout the scene. This can result in slightly improved indirect lighting, but should be used only when rendering still frames. If you use this method when rendering an animation, you will notice a very unpleasant low-frequency pulsation in the indirect lighting.
- **Bucket size:** this drop-down list controls the base grid for the evaluation of the indirect lighting. You will have at least one sample for each bucket. Reducing the bucket size will increase the accuracy of the indirect lighting evaluation, but will also slow down renders quite significantly. This option can be useful if indirect lighting is consistently evaluated wrongly on small parts of your scenes.
- **Show samples:** if you check this option, the points at which the indirect lighting is evaluated will be displayed in the final picture as pixels of the indicated color. This is useful if you want to fine tune the evaluation of the indirect lighting solution and see the effects of the different settings above on this evaluation.
- **Volumetric settings:** this control lets you adjust the overall quality boost of the processing of volumetric effects (materials, lights, clouds).

Photon Maps Tab

Producer...



Advanced Effects Options – Photon Maps Tab

The **Custom radiosity photon map options** frame lets you control the photon map that is used for the evaluation and rendering of radiosity.

- **Radiosity photons:** this setting controls the total number of photons that are sent into the scene in order to evaluate the radiosity illumination.
- **Maximum photon tracing level:** this setting controls how many times the light is bounced inside the scene. Higher values will result in a more accurate evaluation of the radiosity illumination, but also a longer processing time.
- **Custom photon gathering options:** when this option is checked, TPF uses custom options for the photon gathering.
- **Number of gathering photons:** this setting controls the number of photons that are used to evaluate the illumination at each point.
- **Maximum gathering radius:** this setting controls the maximum distance to a photon beyond which the influence of the photon will be ignored in the computation

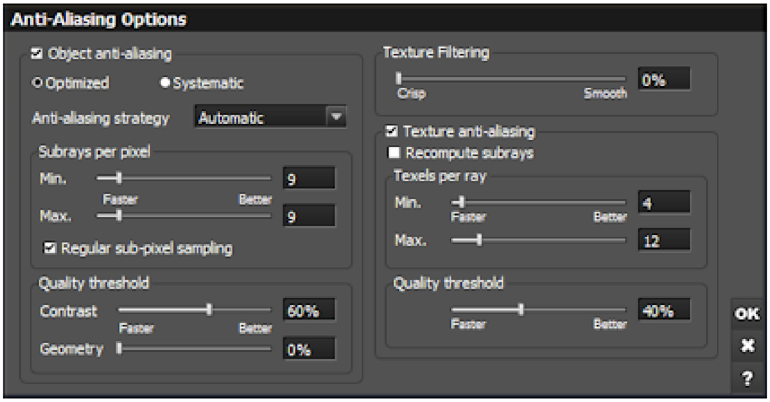
of the radiosity illumination.

- **Custom caustic photon map options:** the settings in this frame are identical to the ones in the radiosity photon map frame, except they apply to the caustic photon map instead of the radiosity photon map.

...Producer

Anti-Aliasing Options

Producer



Anti-Aliasing Options dialog

You can access this dialog by pressing the **Edit** button in the **Anti-aliasing** group in the Render Options dialog. At least one of the anti-aliasing options must be selected for the **Edit** button to be active.

Anti-aliasing is a method used to reduce stair step effects (pixelization) on the edges of objects or textures. The method, called super-sampling, consists of tracing several sub-pixels for every pixel of the picture in order to improve transitions; the result being the creation of half tone pixels alongside the borders of objects/textures.

Anti-aliased pictures give the impression of having been rendered at much higher resolutions than that at which they were really rendered. The small drawback is that sometimes the picture appears slightly blurred. To achieve good results, many sub-pixels must be computed for each pixel, resulting in a considerable increase in render time. To optimize the method, more effort is concentrated on areas of transition.

Aliasing appears along the border of objects, as well as alongside sharp color transitions in texture maps. Object anti-aliasing improves the smoothness of the picture by re-sampling each pixel several times.

Object Anti-Aliasing

Producer

To enable **Object anti-aliasing**, check the corresponding box. Object anti-aliasing takes place at the end of the standard rendering pass.

There are two ways of super-sampling object geometry:

- **Optimized:** method consists in super-sampling only the parts of the picture where transitions are found after the last render pass,
- **Systematic:** method will super-sample every single pixel in the picture during each render pass.

Anti-Aliasing Strategy

Producer

- **Anti-aliasing strategy:** this drop-down list lets you control how the different anti-aliasing samples are weighed into the final pixel:
  - **Automatic:** when this option is selected, the renderer will use the most adapted strategy for each scenario, namely the Sharp method for rendering stills, and the Soft method for rendering animations.
  - **Crisp:** this is the most accurate method, but also the method that requires the most samples in order to eliminate noise in the renders.
  - **Sharp:** this method is ideal for still renders. It produces relatively sharp results while efficiently eliminating noise.
  - **Soft:** this is a slightly more blurry (and consequently less noisy) method of filtering, usually most suitable for rendering animations.
  - **Blurred:** produces blurry results that could be suitable for certain types of animations.

Subrays

Producer...

Super-sampling is handled in the following way: the render engine launches a first batch of rays and then, according to the results of this batch, decides if more sub-rays are required. When no more rays are required, it computes the average color and displays it. Systematic anti-aliasing yields slightly better results than optimized anti-aliasing, but at the expense of render times several times lengthier. It is usually not useful to use systematic anti-aliasing.

In the **Subrays per pixel** group you will find two controls that let you determine the minimum and maximum number of sub-rays computed for each pixel. *...Producer*

The **Min**. setting controls the number of rays initially sent inside a super-sampled pixel.

If the render engine decides that more anti-aliasing rays are required, it will keep sending new batches of rays until the total number of rays sent for that pixel reaches the **Max**. setting. For **Object Anti-Aliasing Options** ultra-smooth results, you can bump this value up to 1024! (although such high values will rarely yield better results than lower settings).

- **Regular sub-pixel sampling:** when this option is selected, the rays in the first batch of sub-rays are placed exactly the same for all the pixels in the image. When it is not selected, sub-rays are cast randomly in each pixel. Although checking this option will usually produce better results, under certain conditions (regular patterns stretching to infinity), it may produce some visual interference. The **Quality threshold** settings control the severity with which the render engine decides whether more rays are required or not, after having computed the first batch. The higher the setting, the more often sub-rays will be sent into pixels.
- **Contrast:** this is a color-based anti-aliasing. This compares colors: if the color difference in the corners is bigger than the threshold (**Contrast** setting), AA is applied.
- **Geometry:** this is an edge-based anti-aliasing. It checks object IDs and depth.

Obviously, the higher these three settings, the better the quality, but the longer the render time...

Texture Filtering

Producer...

Texture filtering controls the amount of automatic blurring that is applied to materials in the scene. This setting lets you control the overall “sharpness” of the render. For optimal results, this setting should be used together with the Anti-aliasing strategy setting (see above). Texture

filtering is available from the **Broadcast** render setting on up through **Ultra**.

In the case of texture maps, the software automatically generates lower resolution versions of the images and uses them instead of the full-blown texture maps when they are seen from a distance.

While the results produced using some amount of filtering are generally smoother, you may occasionally find that your images are not as crisp as you would like them to be.

…Producer

When rendering animations, it is recommended that you use some amount of filtering.

You can disable texture filtering on a per-material basis: see the Material Editor for details on the texture map.

Texture Anti-Aliasing

Producer

Although Object anti-aliasing will take care of sharp color transitions as well, this comes at a high cost in terms of processing time. This is why TPF also offers a solution optimized for textures, known as “Texture anti-aliasing”.

This is a special form of anti-aliasing designed to reduce efficiently aliasing for both bitmap and procedural textures. Object anti-aliasing is good at cleaning up object and shadow boundaries, but some textures might still display some moiré patterns or other unpleasant artifacts (for instance, in the distance because of a high frequency texture patterns, like when you render a ground plane with a checkerboard texture). In such cases, object anti-aliasing is not sufficiently efficient to clean-up rendering and eliminate these conspicuous artifacts in a reasonable time.

Texture anti-aliasing super-samples bitmap or procedural textures in order to properly integrate high frequency pattern repetitions. This very specific task is done much faster than object anti-aliasing, because it concentrates on the local properties of the texture rather than the entire scene. It is done by recomputing several texels (texture elements) for each pixel.

To enable **Texture anti-aliasing,** select the corresponding option. This option must be turned on for anti-aliasing on a per-texture basis (in the Advanced Material Editor) to work. Remember that you can boost or reduce the quality of Texture Anti-Aliasing on a per material basis.

If the **Recompute subrays** option is checked, reflected and refracted rays will be traced for each texel. This can considerably improve anti-aliasing of reflection or refraction patterns, but will slow the anti-aliasing process down significantly. Except for specific cases (e.g. a reflective surface with strong bump mapping), this option is not recommended. If this option is unchecked, reflected and refracted rays will be computed without texture anti-aliasing.

The settings in the **Texels per ray** group are identical in their behavior to the **Subrays per pixel** settings described in Object anti-aliasing above.

G-Buffer Multi-Pass Options

Producer

GBuffer and Multi-Pass Options

To access this dialog, open the Render Options dialog and press the **Edit** button alongside the **G-Buffer** and **Multi-Pass** options or go to the Animation Render Options dialog and press the **G-Buffer / Multi-Pass Options** button.

This dialog is separated in two frames. The first frame controls the G-Buffer rendering options, while the second deals with Multi-Pass rendering.

G-Buffer

Producer

Check the **Generate G-Buffer** option to enable the creation of G-Buffer information. When this option is selected, the controls in the G-Buffer frame become active.

There are two groups of controls in this frame, Rendering and Channels.

Rendering

Producer...

You can activate two G-Buffer rendering features:

- **Force render occluded objects:** if checked, every region occluded by objects will be rendered in the G-Buffer. This allows for the possibility to remove objects from rendering during a post-processing phase or, for instance, to perform accurate motion blur effects without any missing information issues. *…Producer*

- **Generate all anti-aliasing layers**: if checked, anti-aliasing information will be segregated from rendering information and place onto separate layers. This can be useful in addition to the previous feature for extremely accurate object removals in the post-processing phase.

Channels

Producer…

The G-Buffer is organized in a potentially unlimited number of layers. Each layer contains a number of channels of information.

All G-Buffer channels are supported in TPF. Here is the list of the different channels available:

- **Z Depth:** a floating point value representing the distance to the fragment.
- **Material ID:** an integer value that uniquely identifies the material assigned to the object hit in this fragment.
- **Layer ID:** an integer value that identifies the layer that the object belongs to.
- **UV coordinates:** a pair of floating point values in the range of 0 through 1 representing the U and V coordinates of the textures mapped on the fragment.
- **Normals:** an integer value representing the compressed normal vector to the surface of the fragment. This vector is stored in camera view space.
- **Non clamped color:** 4 bytes representing a Ward's Shared Exponent Format encoded color. This is the color that was actually rendered before it was clamped to the visible spectrum.
- **Sub-pixel coverage:** a byte representing the percentage of the pixel covered by this fragment (255 meaning 100% coverage).
- **Render ID:** an integer value that uniquely identifies the object hit in this fragment.
- **Color:** 3 bytes representing the RGB color values of the fragment (after it is clamped to the visible spectrum).
- **Transparency:** 3 bytes representing the RGB color values of the filtering applied to all fragments behind this fragment.
- **Velocity:** two floating point values representing the velocity vector of the fragment

in screen coordinates.

…*Producer*

- **Sub-pixel weight:** 3 bytes representing the actual contribution of this fragment to the final pixel color (it takes transparency of all preceding fragments and this fragment's coverage into account). The final pixel color is the sum of all fragment colors multiplied by their respective sub-pixel weights.
- **Sub-pixel mask:** a 16 bit integer representing a 4×4 grid that indicates the portions of the pixel that are covered by the fragment.

You can specify which channels should be generated in the G-Buffer. If you don't want to generate them all, simply check the ones that are to be generated. Click the **Save to Disk** box to save the GBuffer.

Saving Pictures as RLA or RPF Files

Producer

If you have already rendered a picture (with G-Buffer information enabled) and would like to save the contents of the G-Buffer in a RPF multi-channel file, use any of the methods listed in the Exporting Pictures section below. You can also save the information using the RLA file format, but not all channels of information will be available.

If you want to save the G-Buffer information to file at the time of rendering, choose **Render to disk** in the **Render destination** field of the Render Options dialog, and click the **Options** button. Next to color picture name, click the **Browse** button and choose the **Run-Length Encoded (*.rla)** or **Rich Pixel Format (*.rpf)** picture formats. G-Buffer generation will automatically be checked for you if it wasn't already done, so all you have to do is edit the G-Buffer Options if needed. Then launch rendering and the result will be saved in the RLA or RPF file that you specified. Note: you won't be able to save in RLA or RPF file format if you didn't generate G-Buffer information during the last render. If so, then you will have to re-render your scene after activating G-Buffer information generation. You cannot save in RLA or RPF file format a picture rendered with the **Optimize last render pass** option set (see Render Options dialog), because it isn't possible to generate G-Buffer information in this case.

Saving Animations as RLA or RPF Files

Producer…

In order to save an animation as a series of RLA or RPF files (one for each frame), choose the **Run-Length Encoded (*.rla)** or **Rich** Pixel Format (*.rpf) animation formats in the Advanced Animation Options (click **Browse** button of color channel) and launch the rendering of the animation.

Note: the limitation on optimizing the last render pass (detailed above) also applies to the generation of G-Buffer information for animations. *…Producer*

Multi-Pass

Producer

Check the **Generate Multi-Pass Buffer** option to enable the creation of the Multi-Pass information. When this option is selected, the controls in the Multi-Pass frame become active. Simply add a check along each one of the layers/masks you would like to generate. If you select a category, all the layers/masks of this category will be generated. To rename individual render passes click on the object pass that you want to rename and enter in the new name.

Please note that the more layers/masks you generate, the more system resources will be necessary to perform the rendering.

Rendering Components

Producer…

TPF's multi-pass rendering engine is capable of separating the following render information:

- **Diffuse:** this component contains the colors caused by light diffused by the surface of the object in all directions; it is saved as a normal (i.e. additive) layer in Photoshop documents.
- **Specular:** this component contains the light reflected by the surface of objects; it is saved as a normal (i.e. additive) layer in Photoshop documents.
- **Shadows:** this component contains the shadows cast by objects; it is saved as a product layer in Photoshop documents. This corresponds to shadow applied onto geometry visible in the Diffuse pass, which doesn't include clouds. If cloud shadows were included in this layer, a proper reconstruction of the full render wouldn't be possible, because multiplying diffuse pass by shadow pass would add wrong shadows onto geometry visible through those clouds.
- **Ambient:** this component contains the light created by the ambient lighting term; it is saved as a normal (i.e. additive) layer in Photoshop documents.
- **Refractions:** this component contains the colors refracted through objects; it is saved as a normal (i.e. additive) layer in Photoshop documents.
- **Reflections:** this component contains the colors reflected by objects; it is saved as a normal (i.e. additive) layer in Photoshop documents.

- **Background:** this component contains the background colors; it is saved as a normal (i.e. additive) layer in Photoshop documents. *...Producer*
- **Indirect lighting:** this component contains the lighting caused by other objects in the scene (when rendering with Global Radiosity); it is saved as a normal (i.e. additive) layer in Photoshop documents.
- **Atmosphere filter:** this component, together with the Atmosphere gain component contains the effects of the atmosphere on the rendering. It is necessary to hold this information on two layers, because of a limitation in the Photoshop layer handling (no true additive mode); this component is saved as a normal (i.e. additive) layer in Photoshop documents.
- **Atmosphere gain:** this is the second half of the atmosphere effect; it is saved as a product layer in Photoshop documents.
- **Post process:** this component contains the colors added in post-process (e.g. lens flares, glow) ; it is saved as a normal (i.e. additive) layer in Photoshop documents.

Additionally, if you render an animation with the **Show timecode** on frames option enabled, a **Timecode** layer will be added at the top of the list of layers in the Photoshop document (normal layer).

Extra Components

Producer...

On top of the above rendering components, TPF can also produce the following additional rendering information (not part of the actual picture per se, but potentially useful when post-processing) grouped in the

Extra components category:

- **Z Depth:** indicates the distance to the object at this point.
- **XY Normal:** indicates the direction of the normal vector to the surface of the object at this point, the X component of the vector being stored in the Red byte and the Y component being stored in the Green byte.
- **XYZ Normal:** indicates the direction of the normal vector to the surface of the object at this point in world coordinates, the X component of the vector being stored in the Red byte, the Y component being stored in the Green byte, and the Z component being stored in the Blue byte.
- **UVW coordinates:** indicates the value of the UVW texturing coordinates at this point in world coordinates, the U coordinate being stored in the Red byte, the V coordinate being stored in the Green byte, and the W coordinate being stored in

the Blue byte.

...Producer

- **Diffuse lighting:** indicates the amount of diffuse lighting arriving at the surface of objects at this point, unaffected by object colors.
- **Specular lighting:** indicates the amount of specular lighting hitting the surface of objects at this point, unaffected by object colors.
- **Material color:** indicates the color of the object that was hit at this point, unaffected by light.
- **Object ID:** produces a color coded picture that indicates the ID of the objects at each point in the final image (this information is not anti-aliased).
- **Material ID:** produces a color coded picture that indicates the ID of the material at each point in the final image (this information is not anti-aliased).
- **Global alpha mask:** produces a picture that is black where no object was found, white if an object was hit at this point.
- **Distancetocameraplane:** renders the distance from the camera to the main intersection point, but as if the intersection point is a plane perpendicular to the camera direction.

Object Masks

Producer

Object masks are similar to layer masks, except that they can be created for each object independently. If you unfold the object masks category, you will see a list of all the objects in your scene. Place a check alongside the objects for which you want to generate a mask.

Object masks create color and an alpha image that are designed to work together. The alpha image appears white where the object is directly visible in the final picture, black elsewhere. Object masks are fully anti-aliased.

You can unfold group objects in order to access sub-parts of objects and generate masks only for some sub-parts and not others.

Objects that have an EcoSystem material assigned to them will also appear as groups. If you unfold the group, you will notice that you have the option to generate one mask for the actual object and another mask for the EcoSystem population placed on that object.

Producer...

Material Masks

…Producer

Material masks are similar to object masks, except that they are created based on material rather than object. If you unfold the material masks category, you will see a list of all the materials in your scene. Place a check alongside the materials for which you want to generate a mask.

Material masks create color and an alpha image that are designed to work together. The alpha image appears white where the selected material is directly visible in the final picture, black elsewhere. Material masks are fully anti-aliased.

You cannot generate masks for sub-materials of mixed materials.

Saving as Multi-Layer PSD Files

Producer…

If you want to save the Multi-Pass Buffer information to file at the time of rendering, select the **Save to disk** option.

When this option is selected, you can either save the Multi-Pass information as separate files, or in a convenient multi-layer Photoshop PSD document.

- **Multi-layer PSD (pre-combined):** select this option to save the Multi-Pass information as a single PSD document. All components will be included as layers with the layer combination mode set so that the combination of all layers produces the most similar result as the final picture (the final picture is included on a separate layer for reference).

  It is not possible to achieve a composite picture that is identical to the final render in Photoshop, because Photoshop does not support the “Additive” layer combination mode.

  Masks are saved in the Photoshop document as both a separate layer for the mask color and a separate channel for the mask’s alpha. The number of layers and channels in the final Photoshop document will be displayed alongside the “Multi-layer PSD” option.

  Photoshop only supports a limited number of channels per picture (24 or 56 depending on versions). You should check how many channels are supported by your copy of Photoshop before saving a picture with a lot of masks in it.

- **Separate files:** each component/mask will be saved as a separate file. Masks will be saved as grayscale pictures. **Sample Multi-Layer PSD Export** Select the target file, format and location for the picture(s). If you select the “Multi-layer PSD” option, the file extension is automatically changed to .PSD. If you select the “Separate files” option, the actual file name for each layer/mask will be built from the name you entered plus a layer/mask identification.

- **High Dynamic Range:** TPF generates all multi-pass renders in High Dynamic Range, including all object, cloud and layer masks, rendering components, shadows, reflections, atmospheric contributions, etc.

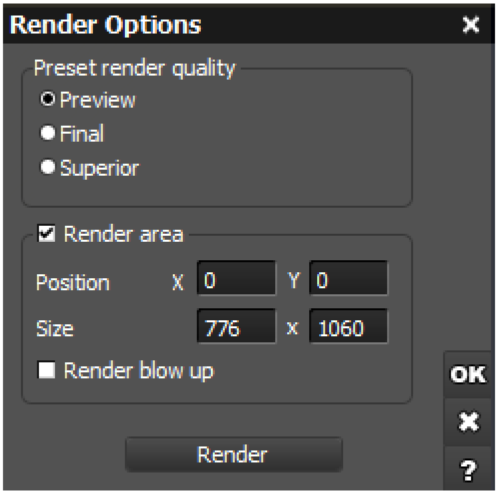
...Producer

Multi-pass renders can be exported as single .exr 32 bit files or .hdr format containing all passes stored in high dynamic range format.

Render Options -- Others

Overview

Artist, Designer, Studio



Render Options

This dialog allows you to select settings for your render. For the most part, you would leave this setting on Preview while you are working on your object. When finished, you might choose a higher setting for a final render.

Preset Render Quality

Artist, Designer, Studio…

- **Preview:** this is the default setting whenever you create a new scene. It is a good working balance between picture quality and render speed. It traces reflections, transparency and cast shadows correctly, although it only mocks-up advanced features like soft shadows, blurred reflections / transparency and depth of field. The last render pass is optimized for speed, and the picture is not anti-aliased. We recommend you stick to this mode while you work on the picture, and only switch to Final settings when you have finished brushing up your scene.
- **Final:** as indicated by the name, this setting produces the final picture. It handles all features correctly, including advanced features such as soft shadows, and applies are reasonable quality anti-aliasing pass. Render times, however, are several times longer than in Preview setting.

- **Superior:** this render setting gives you a higher quality render.

…Artist, Designer, Studio

Render Area

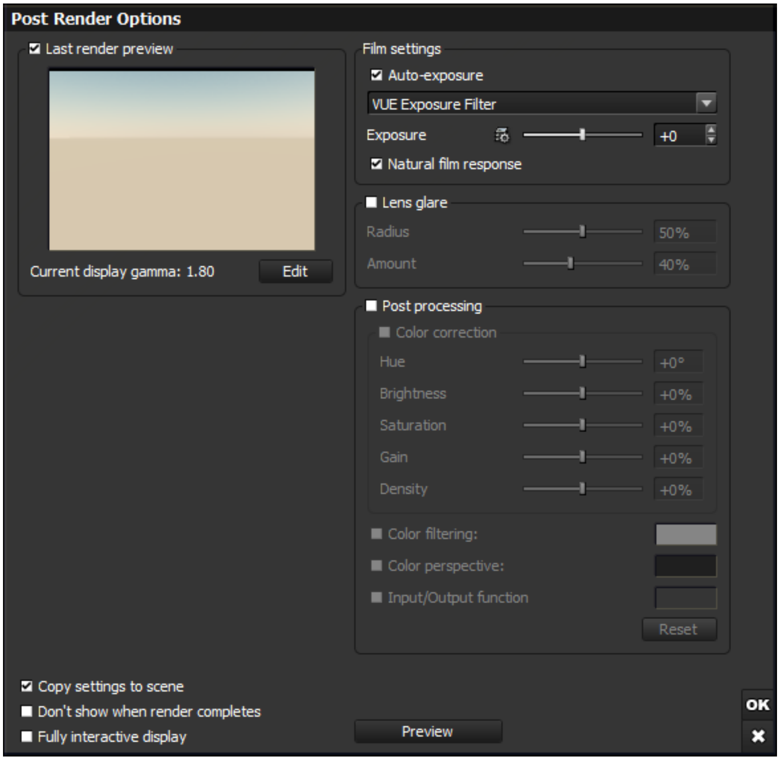
Artist, Designer, Studio

This option lets you select a rectangular area in the picture outside of which the picture won't be rendered. You can also select a render area using the main menu command Render|Select Render Area and then drawing the render area with the mouse.

When you select this option, the render area controls become available:

- **Position:** these two settings let you define the top-left corner of the area to be rendered (in pixels).
- **Size:** these two settings indicate the width and height of the render area (in pixels).
- **Render blow-up:** this option is only available when rendering to screen or to disk. When it is selected, the render area will be rendered at the size of the picture indicated in the Picture size and resolution group. If it is not selected, the picture will be rendered at the exact size indicated. This option is useful when you want to render a close-up of a detail in your picture.

Post Render Options



Post Render Options

The **Post Render Options** dialog appears automatically when rendering completes.

This dialog lets you adjust post-processing options after the rendering completes – including adjusting the exposure.

- **Last render preview:** this picture displays the last render, with a preview of the post processing effects applied to it.
- **Current Display Gamma:** This field displays the current gamma setting. To change this setting, click on the Edit button to display the **Gamma Options** panel. Changes made to the gamma settings here affect only the current image. To change the global gamma settings, access the **Gamma Options** button in the **Options** panel, **General Preferences** tab.
- **Copy settings to scene:** when this option is selected, clicking OK to validate the

changes will copy these changes to the scene.

- **Don't show this dialog when render completes:** when this option is not selected, this dialog will automatically appear when a render completes.
- **Fully interactive display:** Check this box to see any changes you make on this dialog in the Render window as well as the Last render preview window on this dialog.
- **Preview:** click this button to preview the effect on the full size image.

Film Settings

Photochemical films are made of tiny crystals of silver salt that react to light. When light reaches the surface of the film, it hits these crystals and triggers a chemical reaction that switches the state of the crystal (it becomes dark – this process is then inverted to result in a bright point). Once switched, a crystal will not be switched any further by more light hitting it (it can't be more black than black). It is the proportion of switched crystals that increases as light keeps on flooding in, making the point appear darker and darker. But, as more and more crystals have been switched by the incoming light, the chances of hitting an "unswitched" crystal go down. As a result, while points on the film will initially get dark very quickly, it will take more and more light to get them that much darker, resulting in a non-linear reaction to light. This non-linear reaction means that bright areas in the image will appear less bright, and dark areas less dark, resulting in a broader dynamic of light being visible in the final image.

- **Auto-exposure:** the difference in luminosity between noon and dusk is enormous, but we are not necessarily aware of this fact, because the human eye automatically adjusts to the amount of ambient light. Auto-exposure simulates this behavior by automatically adapting the exposure of the camera to the amount of light in the scene. If this option is enabled, your images will be correctly exposed, even if you drag the sun from noon down to dusk. When the auto-exposure option is enabled, the camera re-evaluates its exposure continuously during the rendering process. This is why, when tile rendering mode is enabled, the overall exposure of the image may be adjusted as rendering progresses.
- **Exposure filters:** Vue has several filters you can use to change the effect of your images.
  - **Vue exposure filter:** this is the filter used in all previous Vue versions.
    - **Exposure:** slider controls the general exposure for the filter.
    - **Natural film response:** select this option to enable the non-linear reaction to light typical of photochemical films.
  - **Photographic exposure filter:** provides several settings to tweak the response curve.

        * **Exposure:** slider controls the general exposure for the filter.
        * **Shadows:** will control how dark areas are mapped (lower value will produce lighter shadowed areas, higher values will produce stronger shadows)
        * **Mid-tones:** will control how intermediate intensities will be mapped (lower values will tend to flatten the response curve, effectively producing darker and less contrasted colors, higher values will make the curve steeper, increasing intermediate colors contrast and overall brightness)
        * **Highlights:** control how bright intensities are mapped (lower values will flatten them to avoid saturation, while higher values will produce saturated bright areas).
    - **Linear Exposure filter:** this is the simplest of all of the filters.
        * **Exposure:** exposure can be manually adjusted by this slider. If no contrast transformation is performed, the tone curve is flat, and the user can control how steep the line is. Either **Map entire range** is selected and the brightest rendered color will be mapped to full white, scaling all other colors accordingly or a custom linear coefficient can be specified to control the scaling of colors (1 meaning no scaling at all: raw colors are preserved).
    - **Reinhard tone filter:** there are two flavors of this filter.
        * **A simplified one:** that gives only control over contrast enhancement
        * **Reinhard 2 Exposure Filter:** that lets you control:
            · **Brightness:** an overall scaling factor for the output
            · **Chromatic adaptation:** controls color contrast
            · **Light adaptation:** controls whether the tone operator acts rather locally (higher values) or globally (lower values) across the output picture.

        both types of Reinhard filter allow you to manually adjust exposure.
    - **False colors:** this can be used to visualize output HDR range of intensities of the rendered picture more easily.
- **Exposure:** This setting controls the overall exposure of the camera. Positive values will result in brighter images, whereas negative values will result in darker images. The value is expressed in diaphragms. If the auto-exposure option is enabled, this setting is relative to the automatic exposure value (think of it as a way of "touching up" the auto-exposure).
- **Natural film response:** select this option to enable the non-linear reaction to light typical of photochemical films.

Lens Glare

Lens glare is caused by imperfections in the lenses of real-world cameras. Instead of being perfectly refracted by the lenses of the camera, part of the light becomes diffused by little defects in the glass. This results in halos of light appearing around very bright points of the image. Lens glare gives a soft, realistic look to the final images. The effect, sometimes also referred to as “specular bloom”, is particularly strong when the camera lenses are a little dirty (because light becomes diffused by the layer of dirt at the surface of the lens).

Lens glare is controlled via the following settings:

- **Radius:** this controls the average size of the halos of light that appear around bright points in the image.
- **Amount:** this controls the intensity of the glare effect.

Post Processing

Post processing is a special processing pass that takes place once the picture is completely rendered. Using this feature, you can adjust the colors and brightness of the final picture without having to use another specialized application. By post processing pictures inside TPF rather than using an external application, you ensure that the resulting colors retain all of their subtlety (when you save a picture, the colors in the picture are limited to 8 bits per pixel; artifacts and color banding can appear rapidly as soon as you affect anything but minor post-processing).

To enable post processing of your picture, check the option. The post processing controls become available:

- **Color correction:** select this option to apply color correction to your picture.
- **Hue:** shifts the color tones according to the angle indicated.
- **Brightness:** will increase or reduce the overall brightness of the picture.
- **Saturation:** modifies the overall saturation of the picture.
- **Gain:** applies a smooth contrast to the picture.
- **Density:** adds uniform density to all colors in the picture.
- **Color filtering:** this option lets you apply a color filter to the picture, as if it were seen through a colored gel. When you check this option, you can adjust the corresponding color by double-clicking on the color control.
- **Color perspective:** if you select this option, dark colors will be replaced by the indicated color. Black will be replaced with this exact color, while brighter colors will be blended according to the brightness of the color. When you check this option, you can adjust the corresponding color by double-clicking on the color control.

- **Input/Output Function:** this allows a very accurate tuning of contrasts and luminosity of each color channel (directly on the 32-bit float RGB components). Check the function to enable it. Right-click on the small function preview next to it and select **Edit Filter** in the pop-up menu. The *Color Input/Output Function Filter Editor* displays for changing the settings. See the Editing Filters section for more information about working with filters.

Render Display

Render Display Dialog

The Render Display window displays when the Render to Screen option is selected on the Render Options dialog.

The Render Display window is made up of two sections. The top section is where the render takes place and the current render displays; the bottom section contains an area where previous renders can be stacked and options are available for manipulating them. If the stack option has been activated, a copy of the current render automatically moves to this **Stack** area when the render completes.

Current Render Display

This portion of the screen displays the current render. You can zoom and when the image does not fit the frame, you can drag the image with a left-mouse-button drag.

To the left, under the render screen are a row of buttons:

- **Compare:** this toggles the comparison mode.
- **Swap:** if you have two images selected in the Stack below, clicking this button swaps the two images between the Stack area and the Render Display area.
- **Difference:** this toggles an HDR difference view of the two selected renders for fine tuning differences. The slider adjusts the level of difference.

In the center under the render screen are five buttons:

- **Load:** you can also load an existing image, previously rendered, into the stacked render for reference or comparison.
- **Empty Render Stack:** this clears the stack. There is also a similar icon under each render to delete individual renders.
- **Options:** this opens Render Stacking Option dialog. There, you can turn on and off stacking or define rules for render saving.

When the stack limit is reached a dialog will ask you if you want to stack the current render anyway. This deletes the first render in the stack and replaces it with the current one. You can always increase or decrease the stack size limit.

To the right, under the render screen, are a row of icons that become available when the render completes.

- **Zoom In / Zoom Out:** use these to zoom in or out on the rendered image. Scroll bars become available if the image becomes bigger than the screen display.
- **Full screen:** select this icon to display the render full screen. Press **Esc** to return to the Render Display window.
- **Display Last Render (Color):** displays the last color render.
- **Display Last Render (Alpha):** displays the alpha channel of the last render.
- **Display Last Render (Depth):** displays the depth channel of the last render.
- **Display Multi-Pass, Masks and G-Buffer:** if these options were checked for the render, they can be displayed in the render area. Right-click on the icon to display the options that are available for viewing.
- **Current G-Buffer Layer:** Click to page through the G-buffer layers rendered.

Producer

- **Post Render Options:** click to display the Post Render Options dialog.

- **Save Displayed Picture:** click to open the **Save As** dialog and save the render to disk.

The Render Stack

You can scroll through the renders and click a thumbnail to select it.

Click on the far right icon to display image information and any comments saved with the image.

Delete icon is available for this particular render.

Right-click on the thumbnail to display a menu with the following options. Only options applicable to the render are available; other options are grayed out:

- Clone
- Delete Clone
- Delete
- Delete additional buffers
- Delete gbuffers
- Delete multipass buffers
- Delete relighting buffers
- Delete diagnosis buffers

Producer

Icons under the thumbnail tell you what was rendered with the image (relighting, G-buffer, multi-pass).

Comparison

You can compare the current render with a previous render by first selecting the **Compare** button. This displays the renders available for comparison. Those not available will be marked.

Now move your cursor over the current render. You will see both renders with the cursor functioning as a horizontal separator (white line).

With the **Compare** button still on, if you activate the **Difference** toggle and use the slider to set a non-zero difference value, you can also see a difference display of the two renders. This is done in HDR so it's more powerful than your generic picture editor.

Hiding the Stack

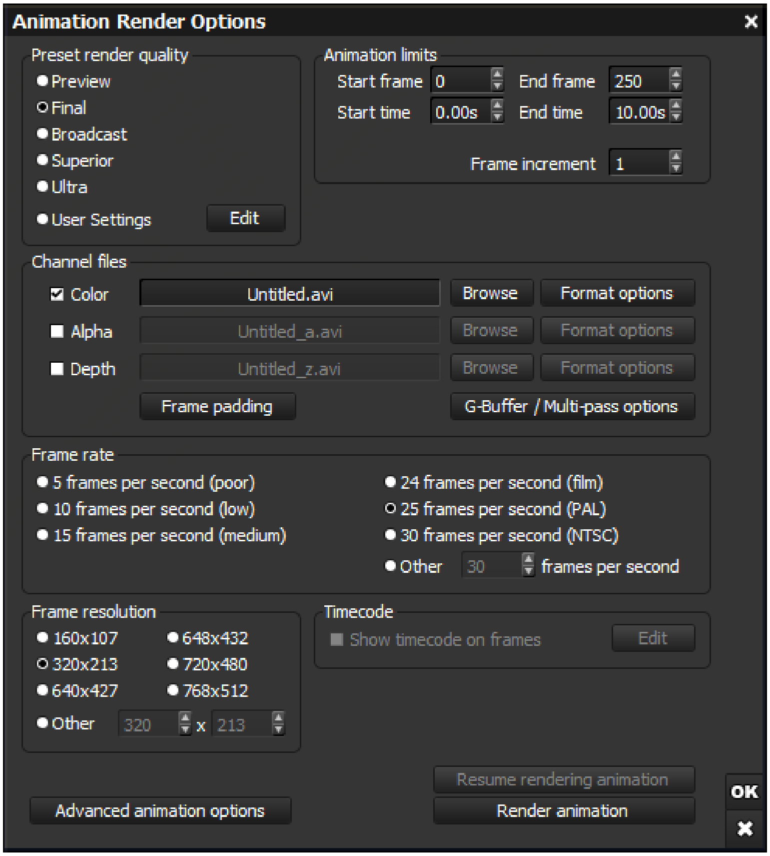
If you aren't using the **Stack** feature, you can hide that part of the Render Display by clicking on the **Minimize** button in the upper-right corner, next to the **Close** icon.

If you wish to redisplay the **Stack** area, click on the now inverted **Minimize** button in the upper-right corner.

Render Animation

The most basic type of animation to render in TPF is wind effects. Wind effects are set in several places to ensure that the correct parts of the plant are acted upon. Also, if you are using animated materials, you need to render animation to show off the effects.

Producer



Animation Render Options

Animation Render Options

Producer…

This dialog lets you control the rendering of your animation.

The **Preset render quality** group lets you select a Preset Render Setting. Please note that Motion Blur is only rendered with **Broadcast** or higher render settings. If you select **User settings**, you can fully customize the render engine by pressing the **Edit** button. See page Render Options for more information. *…Producer*

Use the **Frame resolution** group to indicate the **Animation Render Options dialog** resolution of the frames in the animation (Horizontal × Vertical). The horizontal and vertical resolutions are linked by the aspect ratio of the scene. You can modify this using the Render Options.

The **Animation limits** group lets you indicate the part of the animation that you want to render. You can either enter the limits using Frame numbers, or using Time. The time or frame counterpart is automatically updated. The values in these fields are initialized with the values of the start and end of the active animation part, as defined by the yellow line in the Timeline duration bar.

Frame increment: this setting lets you skip frames in an animation to reduce render time without affecting the frame rate. By default, the Frame increment is one, which means that all the frames in the animation are rendered. Entering 2 will render every other second frame; entering 5 will skip 4 frames after each frame rendered (rendered frames will thus be: 0, 5, 10, 15, 20…).

Channel Files

Producer

TPF can generate and save the three channels (Color, Alpha and Depth) of an animation. Using channels, you can easily composite TPF animations with other animations using an external compositing application. You can also generate full G-Buffer information for each frame, for maximum compositing information.

The **Channel files** group of controls let you select the destination files for the channel animations. By default, only the Color channel is saved (Alpha, Depth, G-Buffer and Multi-Pass channel files are disabled).

Animation File Formats

Producer…

Use the **Browse** buttons to select you want to save the channel animations to, or to change the selected file format. PlantFactory supports the following animation file formats:

- **AVI:** Audio Video Interleaved file format, compressed or uncompressed. Press the **File format options** button to display a standard Codec selection dialog. Using this dialog, you can control how the AVI animation file is compressed.

...Producer

- **M1V:** Mpeg 1 file format (Mac only), compressed. Press the **File format options** button to display a standard options dialog. Using this dialog, you can control how the Mpeg 1 animation file is compressed.
- **MP4V:** (Mac only) QuickTime™ streamable file format, compressed. Press the **File format options** button to display a standard options dialog. Using this dialog, you can control how the QuickTime animation file is compressed.
- **BMP**, **EPX**, **EXR**, **JPG**, **GIF**, **IFF**, **PCX**, **PNG**, **PSD**, **TGA** or **TIFF:** set of stand alone pictures of the indicated file formats,
- **RLA**, **RPF:** set of stand alone Run-Length Encoded (RLA) or Rich Picture Format (RPF) files that contain all the channels of information stored in the G-Buffer (you need to enable G-Buffer rendering to use this option).

Press the **File format options** button to display the standard **Picture Format Options** dialog. The frames of the animation are named after the filename you indicate, with the number of the frame appended to it (e.g. if you save to file Anim.bmp, frames will be named Anim_000000.bmp, Anim_000001.bmp, Anim_000002.bmp, etc.).

- **Frame padding:** click this button to bring up the Frame Name Options dialog. Using this dialog, you can change the zero-padding of the frame file names.
- **G-Buffer / Multi-pass options:** click this button to configure the creation and gathering of G-Buffer and Multi-pass rendering information while rendering the animation. This option is only available when the **Optimize last render pass** option in the Render Options dialog is deselected. If you click this button, the Multi-Pass Options (G-Buffer) dialog will appear, letting you select which rendering components and masks to render.

Note: selecting this option doesn't mean the G-Buffer or Multi-Pass information will be saved in the animation file. You need to select the RLA or RPF file formats (for G-Buffer information), or multi-layer PSD file format (for Multi-Pass information) for this to happen.

Frame Rate

Producer...

This group controls the number of frames that will be rendered for every second of animation. The higher this number, the more smoothly the animation will play back. But the longer it will take to render (and the larger the resulting file).

Bear in mind that the human eye is unable to isolate more than 24 frames per second. So there is no real point in rendering more than 24 frames per second (unless you are rendering for TV video, where there are synchronization concerns requiring and increased frame rate). *...Producer*

The default is 15 frames per second, and produces reasonable smoothness at a reasonable expense.

Frame Resolution

Producer

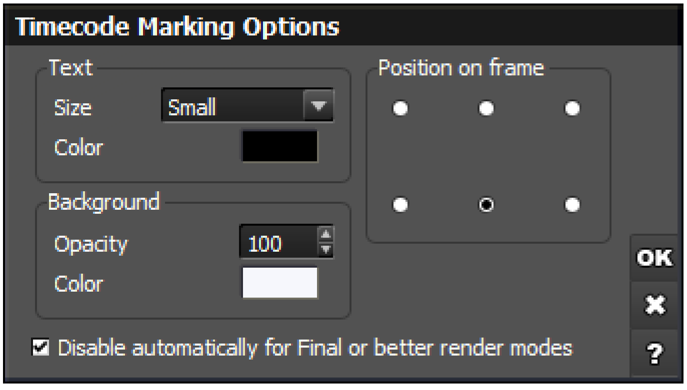
This provides a list of typical animation frame resolutions as well as the ability to define custom frame sizes. If the **Other** frame resolution option is selected, entering a resolution in one of the fields will automatically recompute the corresponding resolution for the other field (according to picture aspect ratio, provided that this aspect ratio hasn't been set to **Free (user defined)**). If you want to change the aspect ratio of your frames, press the **Edit** button in the **Preset Render Quality** frame to access the Render Options dialog.

Timecode

Producer...

The **Show timecode on frames** option will automatically add the frame's timecode on the rendered animation frames. If you are saving the frames as multi-layer PSD files, the timecode will be placed on a separate layer, so that it can be hidden in post work.

Whenever this option is selected, the **Edit** button becomes active. Clicking on this button will display the Timecode Marking Options dialog, letting you configure the color and location of the timecode on the frames.



Timecode Marking Options

...Producer

-
-
-
-
-

Miscellaneous

Producer

- **Advanced Animation Options:** press this button to display the Advanced Animation Options dialog.

Producer...

Closing the Dialog

...Producer

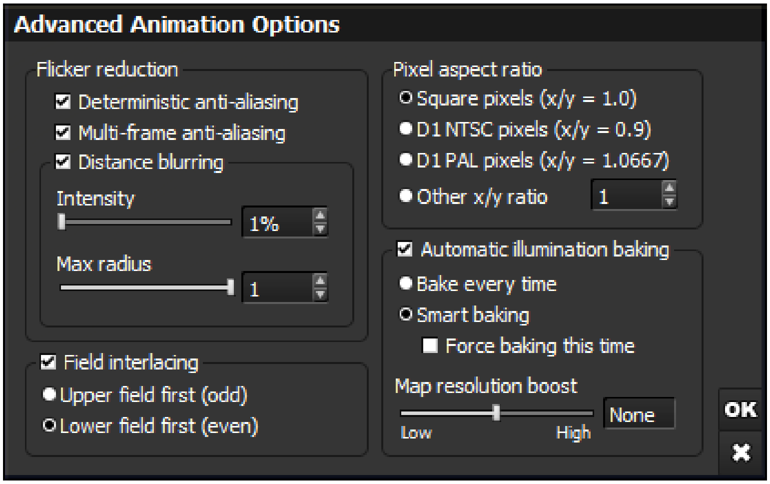
Click **OK** to accept the changes and close the dialog. Click **Cancel** to cancel the changes.

To accept the changes and render the animation with the new settings, click the **Render animation** button.

If you have interrupted a render, the **Resume rendering animation** button will be active. Click on this button to resume rendering the animation. Note that any changes to the render quality will make resuming a render impossible.

Advanced Animation Options

Producer



Advanced Animation Options

Using this dialog you can control advanced animation settings, such as flicker reduction, interlacing, pixel aspect ratios as well as illumination baking.

Flicker Reduction

Producer...

The options in this group let you activate special algorithms to attempt to reduce the dreaded flickering that is so typical of computer graphics animations. While the ultimate solution to eliminate flickering is simply to increase anti-aliasing settings sufficiently, this has a tremendous impact on render times. The methods described below are hacks that will attempt to reduce flickering without having such a dramatic impact on render times:

…Producer

- **Deterministic anti-aliasing:** when this option is enabled (the default), anti-aliasing rays are cast in random patterns that are repeatable from one frame to the next. This almost totally eliminates static noise, but may, under certain very specific circumstances, create patterns that would be noticeable to the eye. However, the impact on image quality is, at worst, barely noticeable. This is why it is recommended that you leave this option on by default.
- **Multi-frame anti-aliasing:** when this option is enabled, TPF will compare the current frame to the previous and the next frame, and try to detect areas of strong flickering to concentrate more rendering samples specifically on those areas. This option requires that the last 3 frames be cached before actual completion of each new frame, and hence only works when rendering an animation. It may also produce a slight blurring of the frames.
- **Distance blurring:** this option lets you artificially blur the frames in the animation. Because flickering appears oftentimes on parts of the scene that are far away from the camera – especially **Advanced Animation Options dialog** with the new EcoSystem technology where you can have very fine geometric details in the distance – this blurring option lets you control the amount of blur according to distance:
- **Intensity:** this setting controls the influence of the distance on the amount of blur. Low settings will blur only objects that are very far from the camera, while high settings will blur all objects in the scene equally.
- **Max. radius:** this setting controls the maximum radius of the blurring that is applied to the pixels in the frame (in pixels). You can use this setting in combination with the Intensity setting to fine tune the blurring of the frames.

In the end, the amount of flicker reduction you apply to your frames should be the result of a compromise between the amount of blur or flickering you can tolerate in your renders, and the amount of time you are willing to spend on the rendering of a particular project.

Field Interlacing

Producer…

Turn this option on to activate field interlacing. Field interlacing will render every other half of a frame, twice as often. This is due to the way video is played back on TV where the screen is refreshed by halves 60 times per second (50 times for PAL). Use this option to ensure perfect playback on TV – and only when rendering for TV. You can select which field will be the first using the

Upper field first or **Lower field first** options. Do not use this setting if you are not rendering for playback on TV. Default is off. *…Producer*

Pixel Aspect Ratio

Producer

Unlike computer monitors, digital edition systems don't always work with square pixels. You can modify the pixel aspect ratio to render animations that will be compatible with these systems. When played back on a computer monitor, the animation will look squashed or stretched.

- **Square pixels:** this is the default setting, e.g. for computer monitors.
- **D1 NTSC pixels:** select this option if you are rendering for D1 NTSC media.
- **D1 PAL pixels:** select this option if you are rendering for D1 PAL media.
- **Other aspect ratio:** use this option to select an alternate pixel aspect ratio. Enter the desired x/y pixel ratio in the corresponding field.

Automatic Illumination Baking

Producer…

Select this option to automatically bake the indirect lighting of all the meshes in the scene prior to rendering the animation.

When this option is selected, all meshes that have not forbidden illumination baking will be baked before rendering the animation. This usually results in dramatic reductions of render times, at the expense of potentially very long preparation times.

You can adjust the way automatic illumination baking is handled using the options in this group:

- **Bake every time:** when this option is selected, the illumination will be baked again each time you begin rendering the animation – whatever the current baking status.
- **Smart baking:** when this option is selected, TPF will check the baking quality of all the meshes in the scene and compare them to the desired rendering quality of the animation. If the current baking quality is greater than required, and if the lighting conditions have not changed, the illumination is not baked for that mesh. If the current baking quality is insufficient, or if TPF determines that lighting conditions have changed, a message will appear asking whether you wish to recompute illumination baking before starting the animation rendering.

- **Force baking this time:** this option is only available when the Smart baking option above is selected. If you check this option, the illumination of all the meshes in the scene will be recomputed this time (the check is automatically removed after completing the baking).
- **Map resolution boost:** this setting controls the overall quality of the baking process. The higher the resolution of the illumination maps, the greater the quality of the baking, and the more detailed the illumination. You can define a base illumination map resolution for each mesh in the scene. This base resolution should be such that, at any time during the animation, the illumination map's resolution will be sufficient to avoid visible artifacts. This setting "boosts" the resolution of the illumination maps of all the objects in the scene by a given boost ratio. This is particularly useful if you decide to increase the output resolution of your animation, because all you have to do is increase the boost factor accordingly. The boost factor works along the principle of octaves (+1 means double resolution, -1 means half resolution).

…Producer

Atmosphere Editor

The **Atmosphere Editor** provides tools to change the lighting and type of atmosphere used in your renders. The **Atmosphere Editor** is designed in a set of tabs. The number of tabs depends on the atmosphere model that is selected:

Producer…

- **Standard atmosphere model:** this model lets you control sky appearance through the use of color gradients. You can control fog and haze densities. The standard model's main advantages are ease of use and fast rendering.
- **Volumetric atmosphere model:** this model offers a good compromise between the standard and spectral models, giving you a higher level of realism, yet rendering faster than spectral atmospheres. Unlike the standard atmosphere, the appearance of the sky and sun is not defined by color gradients. It's directly affected by haze and fog settings and by the sun's position, much like in a real atmosphere.
- **Spectral atmosphere model:** this is a hyper-realistic model that accurately simulates the behavior of real-world atmosphere and lighting according to weather conditions. The appearance of sky and sun as well as the character of direct and ambient light are all affected by the delicate balance between the elements that constitute the atmosphere: air, dust and water particles. The Spectral model provides its own set of controls that let you adjust each element's density and height and rendering quality. Using the Spectral model ensures a complete coherence of all the elements of a scene.
- **Environment mapping:** Especially suited for architectural visualization, this model lets you easily set up an environment based on panoramic photographs. By using HDRI and global reflection mapping you can create a seamless integration between your scene and the background plates.
- **Standard Photometric:** Photometric lighting ensures that relative intensity of sunlight and artificial light sources is physically correct. The absolute intensity is also heavily affected, leading to much brighter daylight renders than before, thus the need for different exposure and natural film response settings that can be handled automatically by PlantFactory internally. If you are changing between a photometric atmosphere and another type of atmosphere model, you are given the option via a popup to let PlantFactory change your current settings to those more appropriate for this atmosphere model automatically. Or you can make adjustments yourself.

The *Atmosphere Editor* can stay open all the time without blocking access to other parts of the software. Modifications are taken into account immediately. You can reset, load and save an atmosphere by using the icons in the dialog bar.

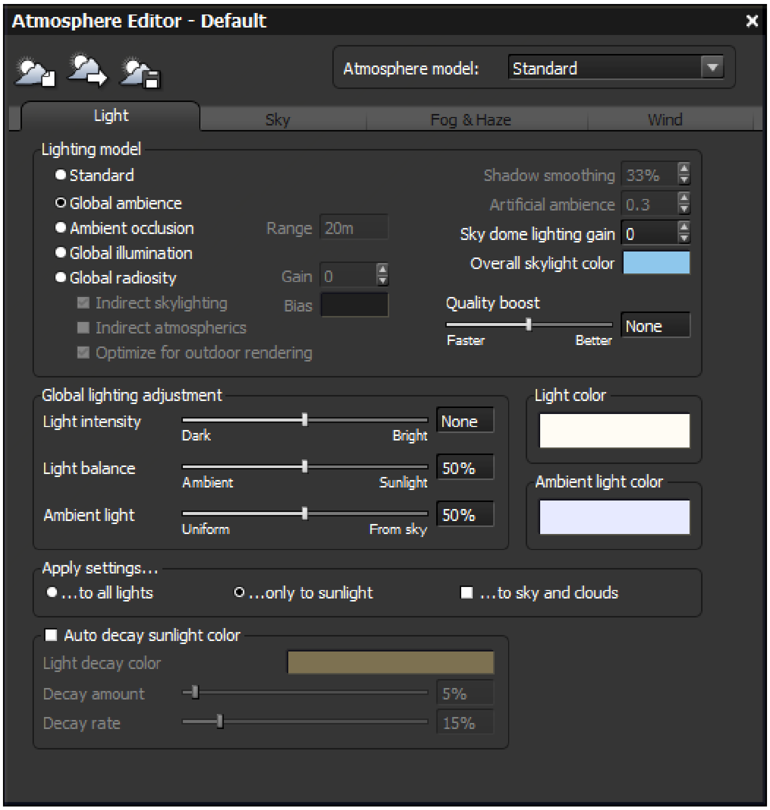
The following is a description of each of the tabs of the Atmosphere Editor. Some of the tabs are not available for certain atmosphere models.

...Producer

- Light
- Sky
- Fog and Haze
- Sky, Fog and Haze
- Wind
- Effects

Light

Producer



Atmosphere Editor – Light Tab

Lighting Model

Producer…

There are 5 lighting models available in TPF:

- Standard,
- Global ambience,
- Ambient occlusion,
- Global illumination, and
- Global radiosity.

Each point of the scene receives light from the sun, the sky as well as from the environment (sky and surrounding objects). The different lighting models differentiate themselves by the way they estimate the amount of light coming from the environment.

- In the **Standard model**, which is the most basic model available, the light coming from the environment is approximated to a constant term known as Ambient light. There is a slight subtlety in the way the standard lighting model defines ambient light: you can define how much of the ambient light is actually coming from the sky (horizontal surfaces will get more of this ambient light than vertical faces) as opposed to ambient light coming from all directions. This is done using the Ambient light slider in the Global lighting adjustment group (see below).
- The **Global ambience** model offers a slightly more elaborate estimation of the light coming from the environment: this model takes into account the color of the sky in all directions. As a result, parts of the scene that look towards blue sky will take on blue shades of light, whereas other parts looking towards red sky will take on red shades of light. The global ambience model will add an interesting touch to your renders while requiring very little rendering overhead.
- **Ambient occlusion** is an improved version of global ambience where each point on the sky dome is considered like a little source of light. Rays are traced towards each one of these lights, to see whether a neighboring object is occluding the light or not. This results in very subtle shadows appearing around objects that are close to one another. Obviously, tracing all these rays increases rendering times significantly; the effects of ambient occlusion are particularly noticeable and pleasing on areas of the scene that are not directly exposed to sources of light. Also, since ambient occlusion computes ambient lighting, it is usually recommended that you increase the contribution of ambient light in your scene when using this model. In order to speed up the rendering process, only neighboring objects that are closer than a given distance are taken into account in the occlusion process. Neighboring objects that are far away contribute less and less to the occlusion. This is a trick that

enables the scene to be rendered much more rapidly than with Global illumination, without compromising too much on quality, because the renderer doesn't need to examine the entire scene to find occluders. When the ambient occlusion model is selected, the ambient occlusion **Range** parameter becomes available. This controls the maximum distance beyond which objects will not contribute to the occlusion. The bigger this value, the closer you get to the Global illumination model and the slower the render. The smaller the value, the closer you get to global ambience (and the quicker the render).

- The **Global illumination** model improves over the ambient occlusion model by tracing light rays all the way to the sky dome, thus ensuring that any object will cast ambient shadows onto other objects, whatever the distance. The result is usually darker than results achieved with the ambient occlusion model. Again, tracing all these rays increases rendering times significantly; the effects of global illumination are particularly noticeable and pleasing on areas of the scene that are not directly exposed to sources of light. Also, since global illumination computes ambient lighting, it is usually recommended that you increase the contribution of ambient light in your scene when using the global illumination model.

Note:

When using ambient occlusion or global illumination, it is essential that you increase the proportion of ambient light in your scene – otherwise you will barely see the effects of the advanced illumination model. You can actually even get very pleasing results with only ambient light (this will results in a very foggy and overcast look).

- The **Global radiosity** model is the ultimate model in terms of quality of illumination and realism. It propagates light in the scene, instead of propagating shadows as the ambient occlusion and global illumination models do. With this model, objects that are exposed to light will re-emit some of that light in all directions, according to the optical properties of their surface. Light will thus "bounce around" repeatedly in the scene, as it would in reality. As a result, each point in the scene receives light from all the other objects in the scene. Obviously, this results in extremely complex computation, and, despite the numerous optimizations implemented in TPF, will lead to render times that are an order of magnitude slower than the standard model – but will also yield incredibly pleasing results. In this mode, the ambient vs. direct lighting slider controls the relative influence of light coming from the sky, versus light coming from light sources such as the sun.

TPF has the ability to preserve the indirect lighting calculation "in-between" renders, even if the scene has been modified. This speeds up dramatically the "tweaking" phase of scene preparation. When this mode is enabled, you can easily request the updating of indirect lighting next time you render, so that it matches any changes made to the scene. See the Indirect Lighting Solution on the Render Options dialog.

...Producer...

When using radiosity, be aware that materials containing luminosity or that have non-standard (60:40) proportions of ambient diffuse light may cause strange lighting effects. These materials may have to be adjusted to achieve the atmosphere effects you desire.

When the global radiosity model is selected, some controls that are specific to this model become available:

- **Indirect skylighting:** when this option is selected, TPF will evaluate the amount of skylight that is received by each object and cast back onto the other objects in the scene. If this option is not selected, the Ambient light color will be used instead of computing the indirect contribution of the skylight. Evaluating the indirect lighting caused by skylight is a slow process. Using the ambient color instead usually yields good enough results.
- **Indirect Atmospherics:** If you wish to take into account the light being reflected from clouds onto the objects in the scene, check this option to account for this effect when calculating indirect lighting.
- **Optimize for outdoor rendering:** When this option is selected, TPF assumes that you are rendering an infinite outdoor landscape. While radiosity usually has a very strong influence for indoor rendering, due to light being trapped into a room and bouncing several times around, it is generally much less noticeable for outdoor scenery due to the light quickly escaping the geometry towards the sky and very rarely getting trapped enough to produce a high contribution. Therefore, this option will lower the order of indirection for radiosity calculations, effectively ignoring highly indirect lighting contribution, thus producing a faster and more robust render.
- **Gain:** this setting controls the intensity of the light that is scattered in between the objects.
- **Bias:** if you define a bias color, this color will be added to the light that objects receive from their environment. For instance, if you add a slightly red color, the shadows and light will take a very slight reddish tone. This setting should only be used for very fine tuning of the effects of radiosity.

When one of the global lighting models is selected, the controls in the right half of the Lighting model group become available. These controls are used to fine tune the effects of the lighting model:

- **Shadow smoothing:** this parameter is available for all lighting modes above global ambience. It is designed to control the overall smoothness of global illumination shadows. Low values will produce sharper and more accurate shadows, but may require higher quality settings to avoid noisy shadows. On the other hand, high values will tend to smooth out shadows, leading to less accurate results, but without the need for high quality settings.

- **Artificial ambience:** this parameter is available in the ambient occlusion and global illumination models. It is designed to compensate for the fact that there is no inter-object light reflection in these models. The indicated amount of ambient light will be added to the sky's contribution to determine the total amount of light that each point receives from its environment. The color of this term can be controlled using the ambient light color setting.
- **Sky dome lighting gain:** this parameter controls the overall intensity of the light received from the sky. Increasing this setting adds more ambient light to your scene. It is somewhat similar to dragging the light balance control towards ambient and increasing the exposure of the scene globally. This control does offer an added level of flexibility, though.
- **Overall skylight color:** this color control represents the overall color of the light coming from the sky dome, and lets you adjust it in order to fine tune the ambient lighting of your scene (double-click on the color control to edit the color). For instance, if you feel that the parts of your scene in the shadows are taking a color tone that is too pronounced, you can reduce the saturation of the overall color. Because this color control represents the overall color of the sky, if you modify the settings of the sky, the color displayed in the control will change. However, the color correction that you indicated by modifying the previous color will still be applied to the new color.
- **Quality boost:** this setting is part of the EasyGI™ technology that synthesizes the complex settings required to efficiently render global illumination into one single quality setting. As with other quality boost settings throughout TPF (such as the volumetric atmosphere quality boost), this setting is used in conjunction with the **Advanced effects quality** setting in the Render Options dialog. When you are putting the scene together and creating **Preview** renders, the quality of the global illumination evaluation is rather crude, but as you decide that the scene is ready for rendering in **Final** mode (see the preset render quality settings of the Render Options dialog), the quality of the computation of global illumination is automatically increased to produce nicer results. The **Quality boost** setting should only be used if you notice that there are some imperfections in the quality of the illumination in the final production render. Alternatively, if you are doing a lot of test renders where the quality of the global illumination is not essential, you can reduce the quality boost setting in order to accelerate the render process.

Producer…

Global Lighting

...Producer

The controls in this group let you adjust the distribution of light throughout your scene. If you are using a global illumination or global radiosity model, it is recommended that you increase the proportion of ambient light in the scene, in order to make the effects of this global illumination more visible.

You may adjust the overall luminosity of your scene using the **Light intensity** control. Please note that exposure only affects the sources of light.

Light balance lets you adjust the relative quantities of light coming from the sun and from the environment (ambient light). Scenes with a bright sky will have lots of ambient light, whereas sunset scenes should have little.

Ambient light balance lets you further customize ambient light by deciding how it is shared between light coming from the sky, and light coming from everywhere (uniform light). Scenes with fog will usually require larger amounts of uniform ambient light, whereas scenes with a bright sky will have lots of light coming from the sky.

Lastly, you get the choice to **Apply these settings** either to all the lights, or only to sunlight. Light color and exposure affect the color and intensity of light sources. If lights in your scene (other than sunlight) are used for the atmosphere, you should apply the settings to **all lights**. Alternatively, if you have for instance a house that is lit up from the inside, you will not want that light to be affected by changes in the exposure outside of the house, so you should select **Only to sunlight**.

If you check the **...to sky and clouds** option, the lighting adjustments will also affect the color of the sky and clouds.

Light Color

Producer...

You can give a different color temperature to the sun light and to the sky / ambient light. Double click on the colors to adjust them.

- **Light color:** acts as a filter for the color of the lights in your scene. Having an orange light color, with a sun color that is green will make the light coming from the sun a darker shade of green. It is a natural phenomenon that sunlight gets warmer (i.e. takes yellow to orange shades) as the sun gets closer to the horizon. Such warm lights can yield pleasing results when exposed objects take on warm shades. This setting does not apply to Spectral atmospheres. To change light color, modify the color of the sun light.
- **Ambient light color:** adjusts the color of ambient lighting, whether light comes

from the sky or from the environment. Since ambient light is diffused by the clouds, it usually has a cooler tone (shades of blue) than that of direct sunlight. *…Producer*

Auto Decay Sunlight Color

Producer

These settings are not available for Spectral atmospheres.

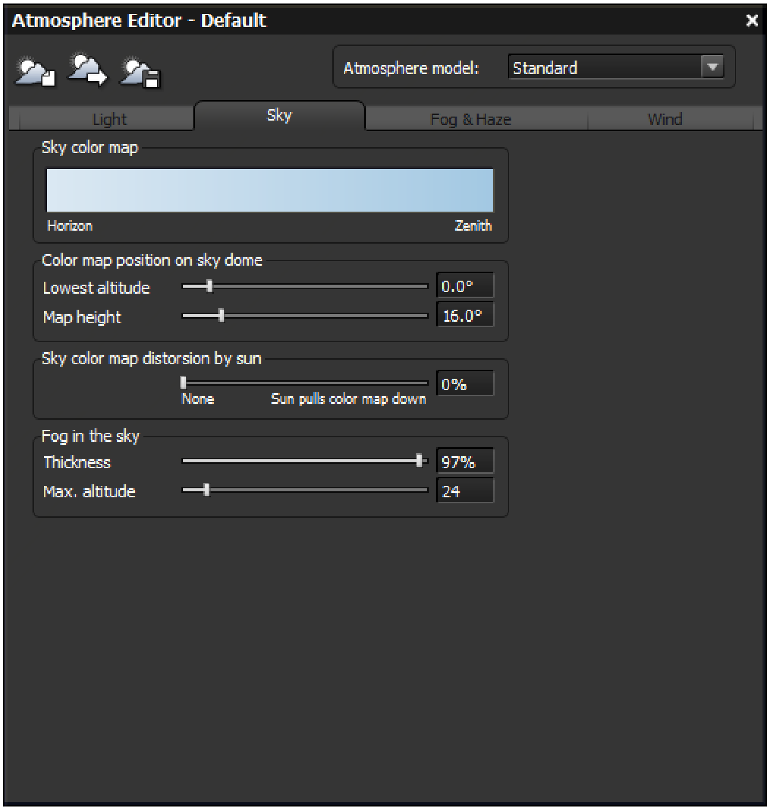
The options in this group control the way the color of light reddens as it gets closer to the horizon. Although this effect is available in both models, it should not be disabled with the Volumetric atmosphere model, because with this model, light is affected by the atmosphere as it travels through it anyway…

Light decay color: this is the color that is used to make the color of light turn to red. By default, the color is R=218, G=171, B=71. Preferably, you shouldn't modify these values, because if you do, you'll probably get unexpected (and unrealistic) results. Entering a different color will completely affect the way light is colored by the atmosphere.

Producer…

Sky

...Producer...



Atmosphere Editor – Sky Tab

This tab deals with the colors of the sky in the standard model of atmosphere. It isn't available in the Volumetric or Spectral models.

The most important control is the **Sky color map**. This is where sky colors are defined. To edit the color map, control-click on it, which will open up the Color map editor.

The color of the sky is generated by vertically mapping these colors. The resulting gradation occurs inside a strip that is pulled down by the sun. This means that colors on the left side of the map will show close to the sun, while colors on the right side of the map show towards the zenith, and it also means that as you get higher in the sky, colors further to the right of the gradation appear.

The two **Color map position on sky dome** controls let you adjust the altitudes at which the gradation starts and ends in the sky. Keep in mind that these altitudes will be modified by the presence of the sun, so probably some experimentation will be required here. *…Producer*

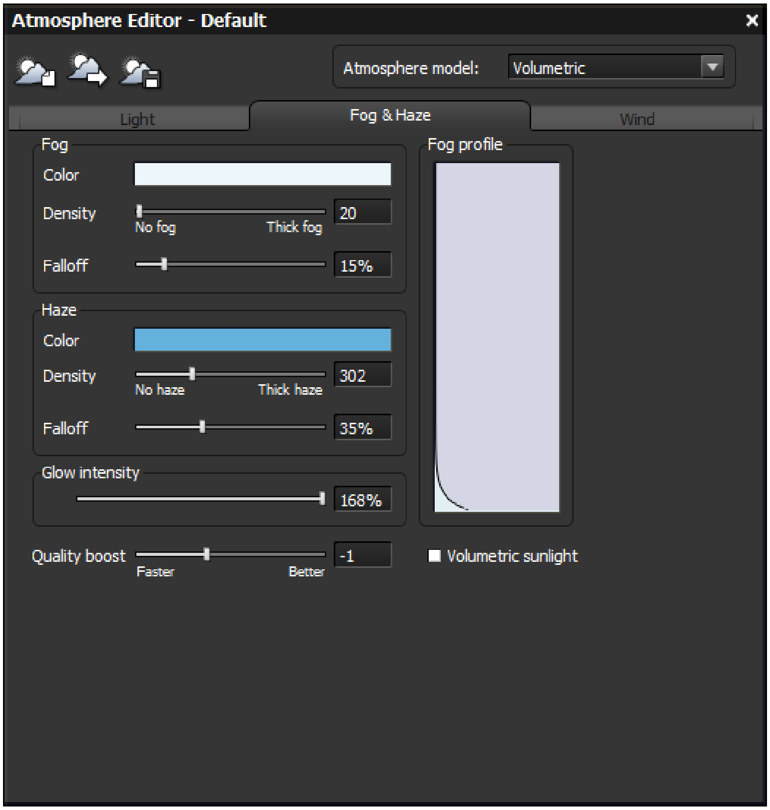
Sky color map distortion by sun controls the effect the sun has on the **Sky color map**. The higher the value, the more distorted the gradation becomes, eventually ending up in circles around the sun. As you get closer to the sun, colors to the left of the map get displayed.

Near the horizon, the sky is often a different color. It is the color of the fog (and haze), creeping up into the sky with distance. You can adjust this effect using two controls: **Thickness** and **Max altitude**. Thickness controls the maximum density of fog achieved at the horizon, and Max altitude controls how high up in the sky the fog is seen.

Producer…

...Producer...

Fog and Haze



Atmosphere Editor – Fog and Haze Tab

The **Fog & Haze** tab is only available in the standard and volumetric atmosphere models. In the spectral model, it is replaced by the Sky, Fog & Haze Tab .

Although you may think fog and haze are used only on special occasions (e.g. to achieve particular photographic atmospheres), this is not the case. Whatever the weather conditions (unless you are out in space), you will find that fog and haze are always present. Fog and haze are what give its color to the sky. What changes is the distance at which they become significant. Fog and haze are important for fine tuning the atmosphere, because they give an idea of distance. This is why nearly all the predefined atmospheres have some amount of fog and haze.

Because fog and haze are responsible for the color of the atmosphere, they are an essential component of the volumetric atmosphere model. It is by adjusting the density of the fog and haze that you will adjust the color of the sky.

This tab looks somewhat different depending on the selected model of atmosphere. *…Producer*

Fog

Producer

Fog is a generic term that covers all types of particles that you find in the atmosphere and that are large enough to reflect light (i.e. larger than the average wavelength of light). This is, in particular, the case of droplets of humidity, but also dust, crystals of ice, etc.

Objects tend to gradually disappear into fog as they move away from the camera.

The further the objects, the more the color of the objects will blend into the color of the fog. There are two types of fog in the standard atmosphere model:

- uniform fog that has constant thickness whatever the altitude,
- altitude dependent fog that has a density that varies exponentially with altitude. In the volumetric atmosphere model, only the second type of fog is available.

Select the fog **Color** by double-clicking on the color box. The color editor pops-up, letting you select the new color.

- **Density:** is the distance at which objects totally disappear inside the fog, regardless of altitude.
- **Falloff:** controls the way that fog gets gradually thinner with altitude. The greater the value, the more rapidly the fog density decreases with altitude. In the standard model, the extra fog controls are enabled only if the fall off rate is non zero.

To help you in understanding how the thickness of the fog works, the curve on the right displays a **Preview** of fog thickness relative to altitude.

Standard Atmosphere Model Only

Producer…

The following controls are available only in the standard atmosphere model:

- If you want the fog to be accumulated in the lower part of the scene (which is usually the case), select the **Fog gathers at low altitudes** box; alternately, if you want fog to accumulate at high altitudes (for instance to render mountains lost in high altitude fog or a smoke filled cave, for that matter), select the other box.

- Indicate the **Altitude** at which altitude dependent fog achieves maximum density. This controls the altitude of the "layer" of fog created by altitude dependent fog. In practice, it is somewhat tricky to use. *…Producer*

Haze

Producer

Haze is particularly strong on hot days. It is caused by light being scattered in all directions when it collides with the very small particles in the atmosphere (molecules of Oxygen and Nitrogen mainly). This is known as Rayleigh scattering, and is the reason why the sky is blue and the sun light turns red near the horizon. Other colors can be observed, depending on the various densities of particles in the air (e.g. the sky can sometimes be green after volcanic eruptions, because of the large quantities of very thin particles of smoke that get thrown into the air by the eruption).

Unlike fog, the effects of haze saturate with distance.

Haze controls are pretty straightforward: if the selected model for the atmosphere is the volumetric one, the controls for haze work exactly like those for fog; if it is the standard one, the fall off setting isn't available, because haze density is considered constant with altitude.

Volumetric Atmosphere Model Only

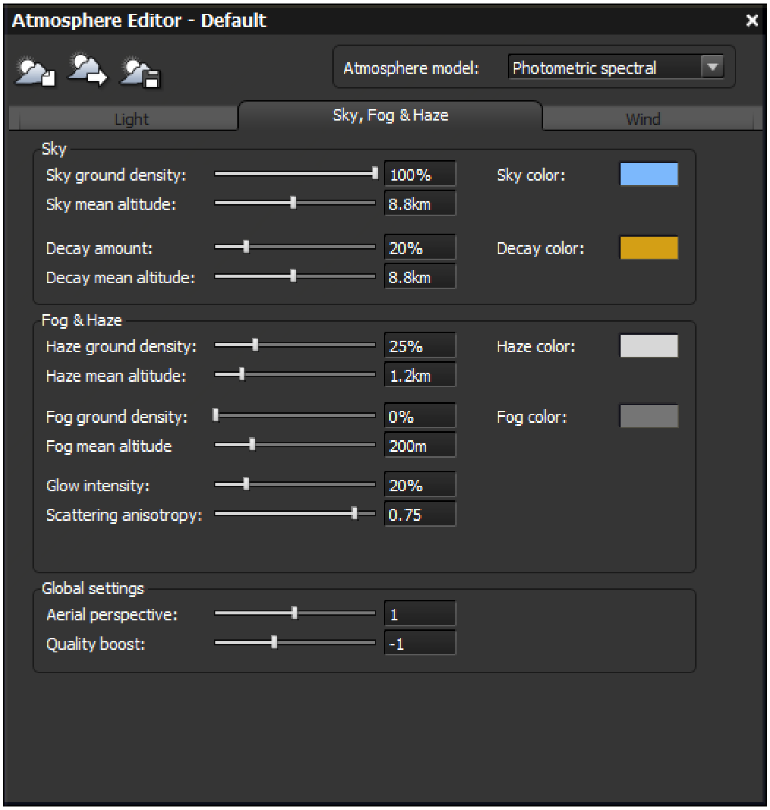
Producer

- **Glow intensity:** this setting controls the intensity of the bright area around the sun, which is caused by the light being reflected on the larger particles in the atmosphere (droplets of water, dust…). The higher the setting, the brighter the atmosphere near the sun.
- **Volumetric sunlight:** check this option to make the sun volumetric. Objects in the scene will start to cast shadows in the atmosphere. The result can be particularly impressive when the sun is low on the horizon. Volumetric sunlight should be used with great care, because they can dramatically increase render times, without necessarily having any noticeable effect.
- **Quality boost:** This setting is available only in the volumetric and spectral atmosphere models. It controls the number of samples that are taken throughout the atmosphere in order to compute the interactions of light with the air. Increase the Quality boost setting if you can see noise in the atmosphere (beware: longer render times will result).

Sky, Fog and Haze

Producer

This tab is specific to the Spectral atmosphere model.



Atmosphere Editor – Sky Fog and Haze Tab

Sky

Producer…

The controls in this group let you adjust the density of the gasses that constitute the atmosphere (namely nitrogen and oxygen). On earth, these gasses are responsible for the blue color of the sky, and the reddening of the sun near the horizon.

The first set of controls in this group are related to the sky, and the way the blue color appears:

- **Sky ground density:** this setting controls the density of the atmospheric gasses at ground altitude.
- **Sky mean altitude:** this indicates the rate at which the density of the atmospheric gasses drops with altitude. The lower the mean altitude, the more quickly the density drops (the atmosphere density is exponential with altitude).
- **Mean altitude:** this is the altitude where density reaches half the density at ground level. Because density is exponential with altitude, this is usually a lot less than half the maximum altitude of the component. For instance, we know that the Earth's atmosphere reaches up to approximately 60 miles high, but it's mean altitude is only 5.5 miles (at an altitude of 5.5 miles, the density of the atmosphere is half of that at ground level).
- **Sky color:** this lets you change the color shift caused by the gasses in the atmosphere. On earth, this color is blue, but you can imagine alien planets where the gasses in the atmosphere result in a different color for the atmosphere.

…Producer

The other settings in this group are relative to the color decay caused by atmospheric gasses. This controls the way the color of light turns red as the sun gets closer to the horizon:

- **Decay amount:** this is the amount of reddening that occurs as the sun gets closer to the horizon.
- **Decay mean altitude:** like for sky, this controls the rate at which the decay disappears with increasing altitudes.
- **Decay color:** on earth, the atmospheric gasses result in a blue color in the sky, and a reddening of light near the horizon. However, the gasses in the atmospheres of other planets could result in a different base sky color and light decay. This setting lets you change the color hue taken by the sun as it gets lower on the horizon. For earthen atmospheres, you shouldn't need to modify the sky and decay colors.

Fog and Haze

Producer…

The settings in this group control the other components of the atmosphere: small particles, such as dust, and humidity. Small particles are responsible for the haze while humidity is responsible for fog. The settings for **Fog and Haze** work like **Sky and Decay** above: {{BulletList |Haze ground density|this indicates the density of particles of dust and pollution at ground altitude. Haze is typically responsible for the gray color that appears near the horizon when the sun is high up in the sky. |Haze mean altitude|controls the rate at which the density of small particles in the atmosphere drops with altitude. |Haze color|controls the color that is added to the atmosphere as a result of the small particles. Usually, this color is gray. |Fog ground density|this indicates the density of water particles at ground altitude. These water particles create a strong glow effect when illuminated from behind. When there is a lot of humidity in the atmosphere, the atmosphere becomes gradually opaque. |Fog mean altitude|controls the rate at which the density of water particles in the atmosphere drops with altitude. |Fog color|controls the color that is added to the atmosphere as a result of the water particles. Usually, this color is a dark shade of gray. |Glow intensity|glow is caused by water particles being illuminated from behind. They result in a bright glow around the sun. This setting lets you control the amount of glow in the atmosphere around the sun. |Scattering anisotropy|this controls how "directional" the glow effect is. It influences the overall shape of the glow effect around the sun, and how bright the fog is depending on the direction you look at. *…Producer*

Global Settings

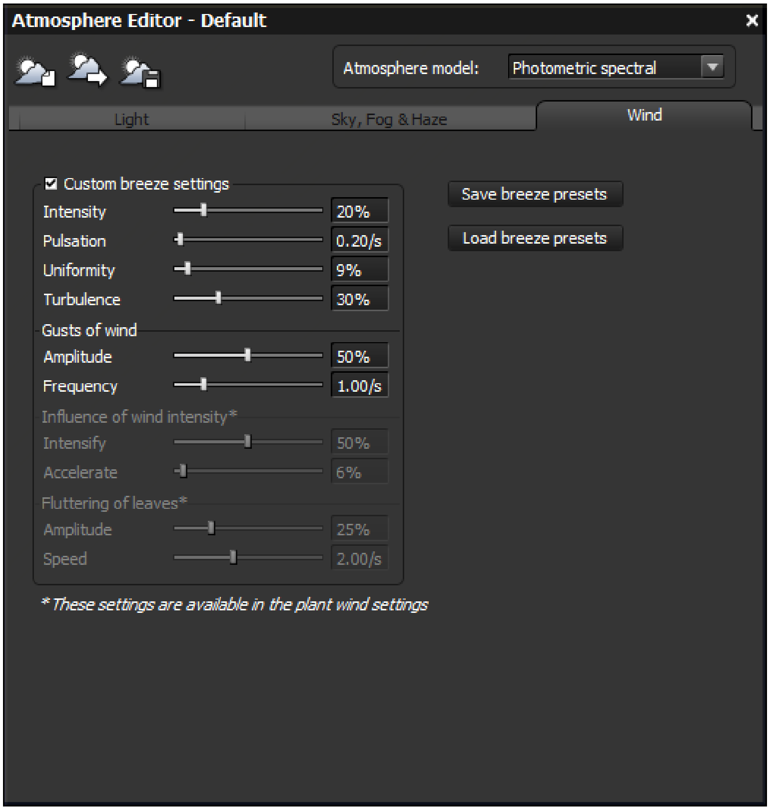
Producer

- **Aerial perspective:** this setting controls the overall "thickness" of the atmosphere. A value of 1 corresponds to the typical Earth atmosphere. If you increase this value, the effect, in terms of atmosphere, will be like increasing the scale of your scene.
  In the preset atmospheres, this value is usually set to 10, so that the effects of the atmosphere can be seen without having to use "real-world" size environments. If you are looking for physical accuracy, you should reset this value to 1, which is the aerial perspective of the Earth's atmosphere. You should also construct your environments at Earth scale (hundreds of miles).
- **Quality boost:** This setting is available only in the volumetric and spectral atmosphere models. It controls the number of samples that are taken throughout the atmosphere in order to compute the interactions of light with the air. Increase the Quality boost setting if you can see noise in the atmosphere (beware: longer render times will result).

Producer…

Wind

…Producer…



Atmosphere Editor – Wind Tab

This tab lets you control the nature and the amount of breeze that is applied to the plants in your scene. All plants created in TPF will automatically move gently in the breeze.

- **Custom breeze settings:** check this option if you want to define custom breeze settings. Otherwise, default breeze settings will be used. It is recommended to use default breeze settings to create plant for VUE.
- **Save breeze presets:** click to save your custom breeze settings.
- **Load breeze presets:** click to load some custom breeze settings.

Note: do not confuse breeze and wind. Breeze is defined globally and applies to all plants. It is suitable for gentle, automatic movements of plants. Wind is defined on a per-plant basis, and is better suited for strong amplitude movement of the plants.

…Producer

Breeze Settings

Producer

In this section we take a closer look at the different settings that let you control the breeze effect.

- **Intensity:** this setting controls the overall intensity of the breeze. Low values mean very gentle breeze, while higher values will produce stronger movement of the plants. Note that when you vary the intensity of the breeze, you should also modify the other settings in order to capture realistic breeze movements.
- **Pulsation:** this setting controls the average speed of the plant movements created by the breeze. Use low values when recreating gentle breeze, but increase it if you are creating a stronger effect.
- **Uniformity:** the effect of the breeze is global throughout the scene; however, when you look at real plants moving in gentle breeze, you will notice that each plant seems to move independently. But you can also see an overall movement sliding across the landscape as stronger gusts of wind blow by. This effect is simulated by breeze, and is controlled by the uniformity setting. Low values mean that the plants move independently, whereas high values mean that the plants move all together.
- **Turbulence:** the turbulence setting controls the amount of random movement of each leaf on the plant (as caused by turbulence in the air). Low values mean that all the leaves move together, and high values mean that all leaves move independently.

Gusts of Wind

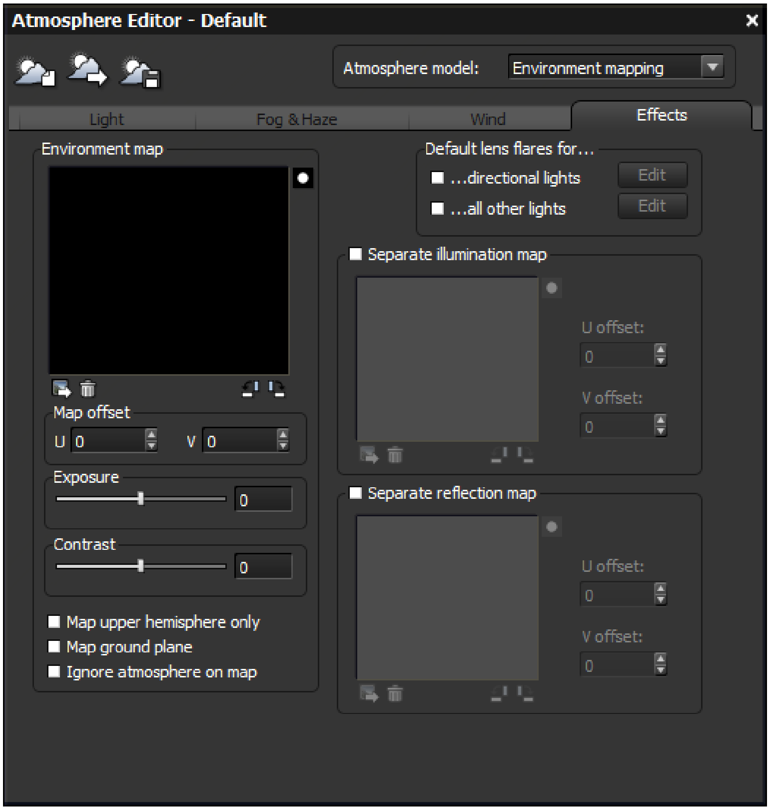
Producer

Gusts of wind appear randomly on top of the overall breeze. They create sudden movements of greater amplitude. The controls in this group let you customize the influence of the gusts of wind:

- **Amplitude:** this setting controls the overall amplitude of the movement caused by the gusts of wind. Low values mean that the gusts of wind create very little noticeable effect, whereas high values mean that gusts of wind will cause strong movements within plants. Gusts of wind appear with random amplitude.
- **Frequency:** this setting controls the average rate at which the gusts of wind occur. Because gusts of wind appear randomly, this setting only indicates the average lapse of time between two gusts of wind. Also, because the amplitude of the gusts is random, not all gusts of wind will necessarily cause noticeable results.

Effects

Producer



Atmosphere Editor – Effects Tab

Environment Map -- Effects Tab

Producer…

This group of controls is only available when the **Environment mapping** model is selected. The main control in this group lets you define the image to be used as an environment map. The picture you select will appear in the back of your render, in place of the sky.

Click the **Load** icon below the picture preview, or double-click on the picture preview to open the Picture Browser and load a picture. If the picture you load does not map seamlessly (meaning that a seam appears on the edge of the picture when it is mapped onto the background), TPF will detect this and offer to create a seamless joint.

…Producer…

When you load a picture as environment map, a message appears, asking you if you want to setup your scene for Image Based Lighting. If you click **Yes**, global illumination will be enabled and the lighting information in the picture will be used to illuminate the scene.

You don't have to use a HDRI image for Image Based Lighting. However, HDRI images produce the nicest results because they contain actual sources of light. If you use a standard picture, you will probably have to increase the sky dome lighting gain to compensate for the fact that there is no light in the map.

If you click **No** to the aforementioned message, the picture you loaded will simply be used as a background to your scene.

You can rotate the picture by using the and arrows. You can also invert the picture using the button. To remove the picture, click the **Remove** icon () below the picture preview.

You can opt to animate the environmental map. The **Animated texture options** icon () is located directly under the picture.

The **Map offset** controls let you fine tune the placement on the environment map on the environment hemisphere. The **U** parameter will rotate the picture around the vertical axis, whereas the **V** parameter will move it up or down. Acceptable values for both parameters are in the range of 0 to 1. The **Exposure** and **Contrast** sliders let you adjust the exposure and contrast of the environment map. If the current environment map is a high dynamic range image, you can view the entire image's dynamic by sliding the exposure setting up and down.

- **Map upper hemisphere only:** check this option if the picture you are using as environment map should be entirely visible above the ground. If this option is not selected, the environment map picture will be mapped to a sphere that entirely encompasses the scene.
- **Map ground plane:** when this option is selected, the lower half of the environment map is automatically mapped onto the ground plane. This will produce particularly nice results when the horizon in the environment map is exactly halfway up the picture.
- **Ignore atmosphere on map:** if you check this option, the effects of the atmosphere (i.e. fog and haze) won't be visible on the environment map. This is very useful when you need to match the atmosphere of the scene with the atmosphere that is visible in the picture background. For instance, if the background picture show a rainy day, you will probably need to add fog to the scene – or else the

objects in your scene will look fake and out of place.

Section 8
Appendices

Glossary

File Formats

PlantFactory File Formats and Plant Sharing

PlantFactory (TPF) offers a variety of mechanisms for creating, exporting, and sharing plants. Following is a list of the TPF file formats and their associated capabilities:

- **.tpfp:**
  - **Name:** Plant Factory Producer File Format
  - **Description:** Native File Format of Plant Factory Producer Models including plant graph and scene information
  - **Available In:** Plant Factory Producer Only
  - **Useable In:** Plant Factory Producer Only
  - **Distribution and Sharing:** Can be shared with anyone in your facility using Plant Factory Producer, or privately with a client using Plant Factory Producer.
- **.tpfs:**
  - **Name:** Plant Factory Scene Format
  - **Description:** Native file format of Plant Factory Studio, Designer and Artist. Contains the plant graph and scene information (e.g. lighting, rendering settings, etc). May be either readable by all (e-on developed plants only) or Node-Locked (readable only by a specific copy of Plant Factory – the default for all plants saved in .tpfs format)
  - **Available In:** All Plant Factory Versions (except Exporter)
  - **Useable In:** All Plant Factory Versions (except Exporter)
  - **Distribution and Sharing:** Cannot be shared or distributed – tied to a specific node-locked copy of Plant Factory
- **.tpfc3d:**
  - **Name:** Plant Factory Cornucopia 3D Format
  - **Description:** Export format used solely for transferring plants to Cornucopia3D for distribution on the Cornucopia3D content store
  - **Available In:** All Plant Factory Versions (except Exporter)
  - **Useable In:** Uploading Plants to Cornucopia 3D

  - **Distribution and Sharing:** Export format only – not readable or useable by Plant Factory

- **.tpf:**
  - **Name:** Plant Factory Plant Format
  - **Description:** Node-Locked encrypted file format for Plant Factory Plant definitions. The file format of plants sold on Cornucopia3D and/or exported into Vue.
  - **Available In:** All Plant Factory Versions and Vue 11 or greater
  - **Useable In:** All Plant Factory Versions and Vue 11 or greater
  - **Distribution and Sharing:** Tied to a specific node – works with Vue 11 or greater and all versions of Plant Factory. Cannot be shared or distributed outside of Cornucopia3D.

At the top end of the spectrum, TPF Producer files (.tpfp) allow complete plant definitions and TPF scenes to be created and shared with any TPF Producer user. TPFP files are not encrypted, but can only be loaded on TPF Producer. They are not readable by any other non-Producer version of TPF or Vue. The licensing terms of TPFP prohibits selling TPFP files publicly, but they can be freely shared with other TPF Producer users inside your facility, or, if you are contracting for a client, you can share them privately with your client.

TPF Scene files (.tpfs) are identical to TPFP files except that they are encrypted and tied to a specific TPF license. They are useable in all versions of TPF (except Exporter). TPF Scene files cannot be shared with any other TPF users since they are encrypted to run only on the source system. Most e-on developed Plant Factory content is distributed in .tpfs format using a generalized encryption mechanism that will allow it to run on any copy of TPF. For user developed plants, TPF Scene files are saved using node-specific encryption which ties the file to the copy of TPF which authored the file.

TPF Cornucopia3D (.tpfc3d) files are a special export file format for uploading plants to the Cornucopia3D marketplace. Once uploaded, these files can be sold or shared with any TPF or Vue users. For more information, see Brokering at Cornucopia3D.

TPF files are encrypted plant definition files that contain the procedural plant graph. Unlike .tpfp and .tpfs files, they contain no scene information such as lighting or rendering settings. TPF files employ platform specific encryption (e.g. tied to a specific computer) and can run with any version of TPF or Vue. The TPF file format is the content format used when acquiring plants on Cornucopia3D.

Component

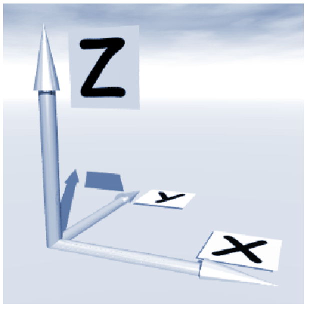
A **Component** is a ready-to-use set of nodes. It is stored as a (.tpc) file.

Components can be incorporated into the main graph directly or by painting (see Component dialog for more information)

A component can also be imported as a whole plant (see menu). Your plant will be replaced by the loaded component.

3D Coordinates

World Space



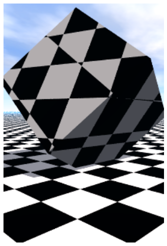
The three axes of world space

To understand how objects are positioned and oriented relative to each other, we have to define a coordinate system. In PlantFactory, this is (very classically) constructed from 3 axes, all at right angles from one another.

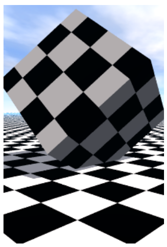
The center of the world, also known as the origin, is the point located in the middle of the preview, when you create a new scene. All positions are indicated relative to this point.

The vertical axis is known as the Z axis, with positive numbers representing points above the ground, and negative ones representing points under the ground. Although this may seem unusual, it is the correct International Unit System.

Object Space



World space



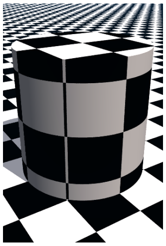
Object space

Same material, different space

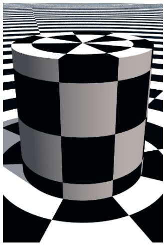
Object space is linked to an object, and is independent from the orientation of the object inside the World. You may rotate, stretch and twist an object in any way you like, object space will still indicate the same axes for the object, because it is relative to that object.

It is important to understand the difference between the two coordinate systems, and when each one is used. The *3D view* operates only in world space, that is, object independent coordinates.

Material Mapping Coordinates



Standard

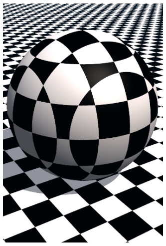


Cylindrical

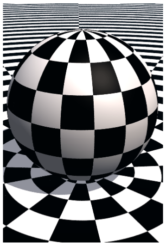
Same material, different mapping

Materials can be expressed in either coordinate system. Imagine you have a cube, made out of a black and white checker pattern. If you rotate the cube, the checker pattern won't fit the object any more. The solution consists in defining the material as being in Object space, so that the axes of the checkerboard match those of the object. Obviously, this is not what you would want all the time.

Both of the coordinate systems can be represented in either one of 4 modes:



Standard



Spherical

Same material, different mapping

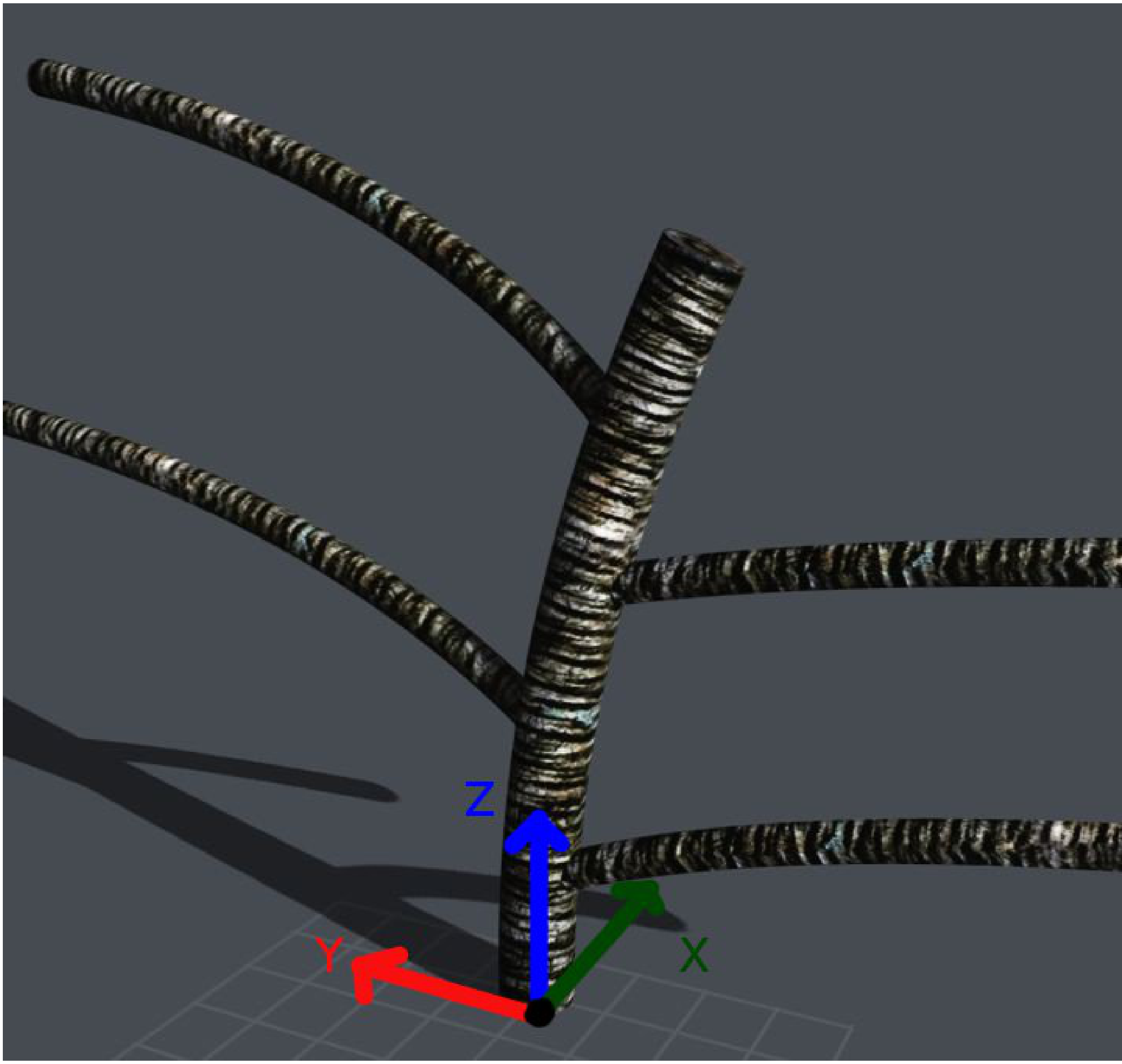
- **Standard:** this is the standard (Cartesian) coordinate system, where X and Y represent the coordinates of the point in the horizontal plane, and Z represents the vertical elevation.
- **Cylindrical:** X represents the distance to the vertical axis, Y represents the angle (in the horizontal plane) of the line that joins the point to the origin, and Z represents the vertical elevation. Cylindrical mapping is best suited for cylindrical objects.
- **Spherical:** X represents the distance to the vertical axis, Y represents the angle (in the horizontal plane) of the line that joins the point to the origin (the heading), and Z represents the pitch of that same line. Spherical mapping is best suited for spherical objects.
- **Parametric:** in this mode, the mapping coordinates are automatically adjusted in such a way that they are independent on the size of the object. This mode is particularly useful when mapping e.g. a picture on a cube, because resizing the cube will not affect the number of times the picture is mapped on the cube.

Since cylindrical, spherical and parametric mapping modes are computed relative to the origin, they give best results when expressed in Object coordinates (because in these coordinates, the origin is the center of the object).

Global Coordinates

Origin : Plant root (as defined in the General parameters tab of the Plant root node)

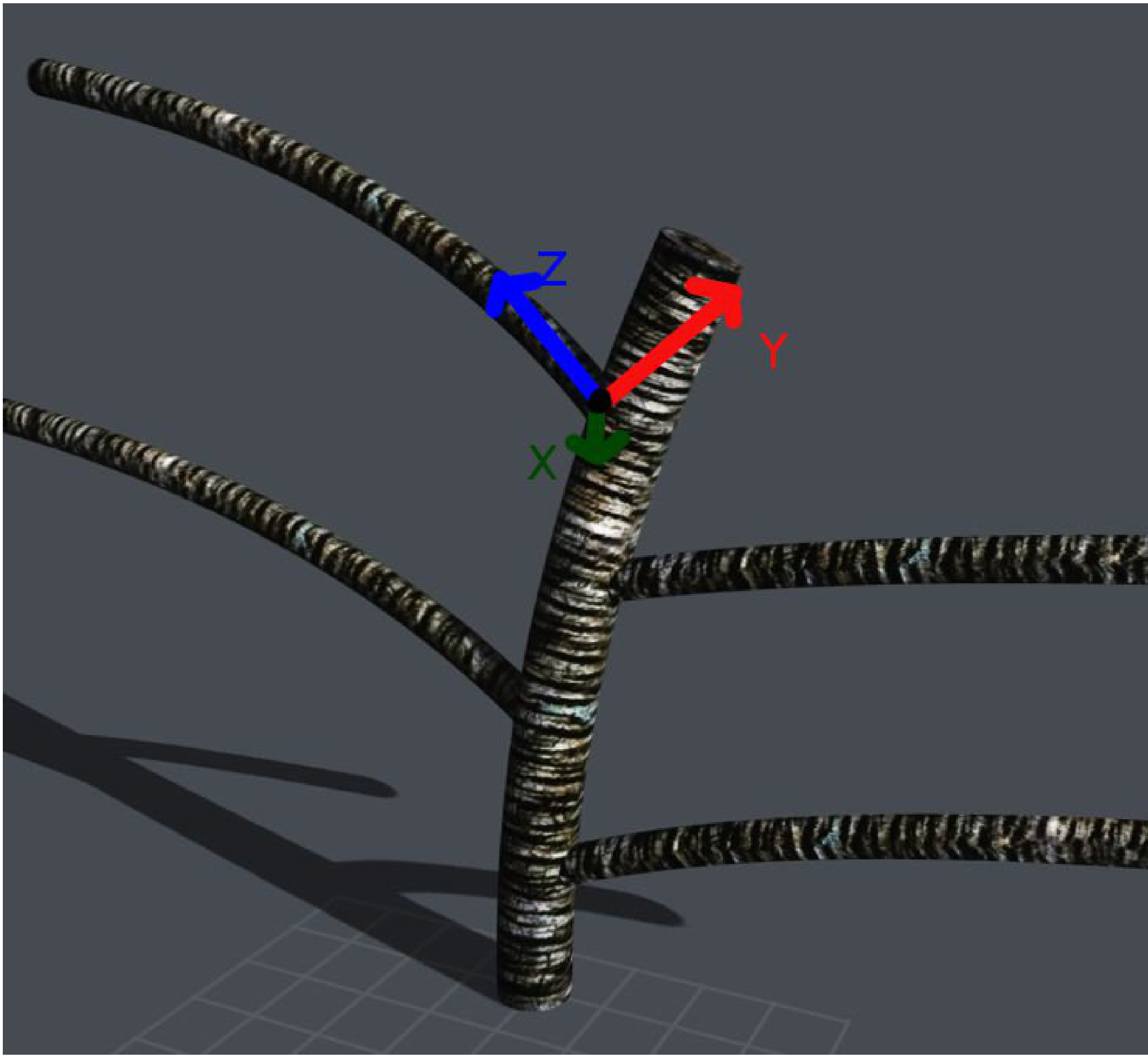
Z-axis : Trunk initial direction



Local Coordinates

Origin : Primitive instance starting position

Z-axis : Primitive instance starting direction



Parametrization

Any point of a segment may be referred to using cylindrical coordinates :

- the **Primal** coordinate is the position on the segment axis, ranging from 0 (segment bottom) to 1 (segment top)

- the **Section angle** coordinate is the angular position of the point in the plane orthogonal to the segment axis. It ranges from 0 to 1.
- the **Radial** coordinate is the distance from the segment axis. It is always positive.

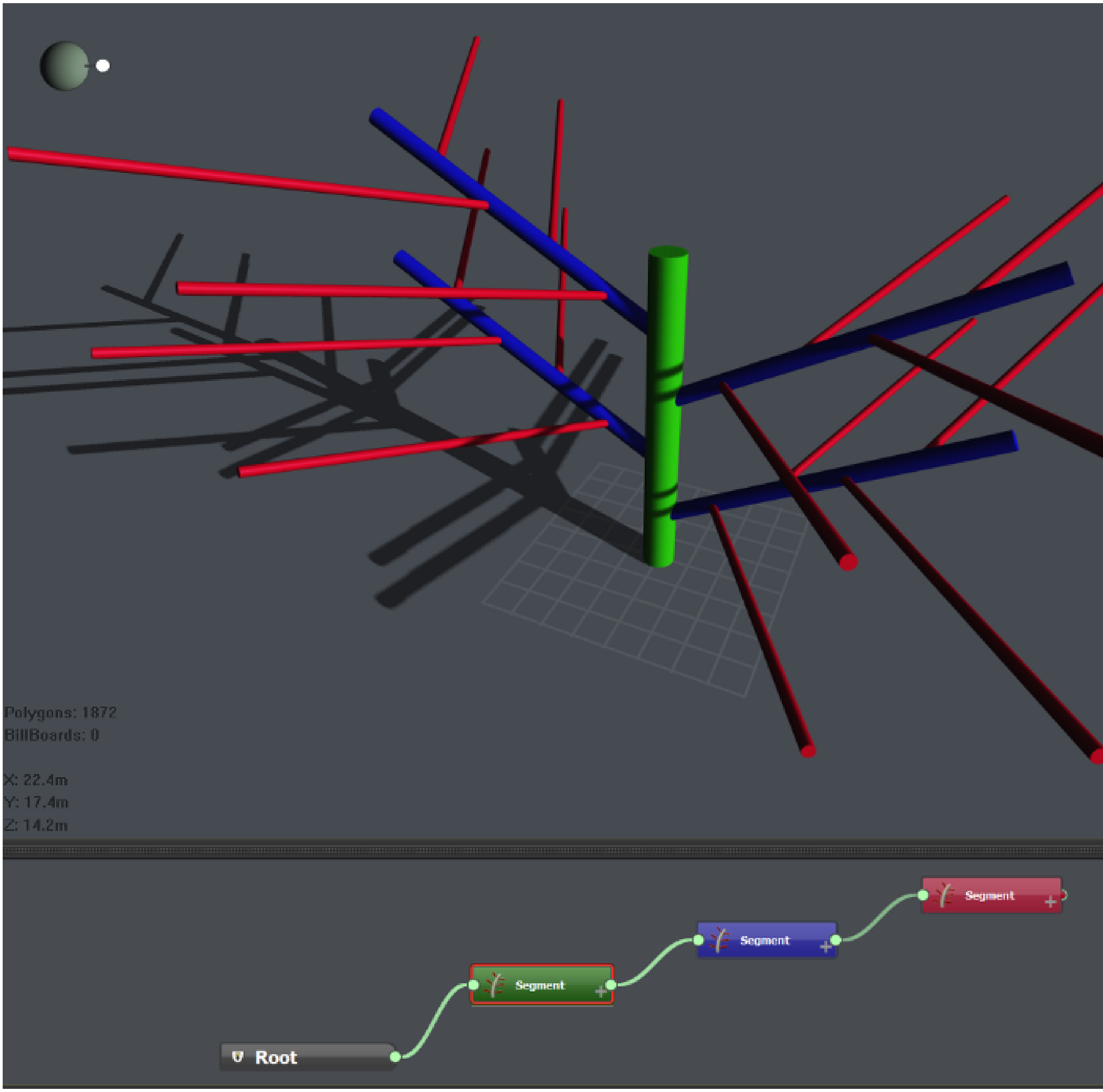
Those coordinates may be used as inputs in the graph, using the Primal, Section angle and Radial nodes.

The primal coordinate is used to compute ancestor coordinate.

Primitive Instance

A primitive instance is an indivisible subpart of the plant geometry that was generated from the evaluation of a single node.

Example



In this example, the graph contains 3 Segment nodes. The geometry was colored with node color in the Plant preview window and we see that the generated geometry is made of :

- **1 green** primitive instance (the trunk)
- **4 blue** primitive instances
- **16 red** primitive instances

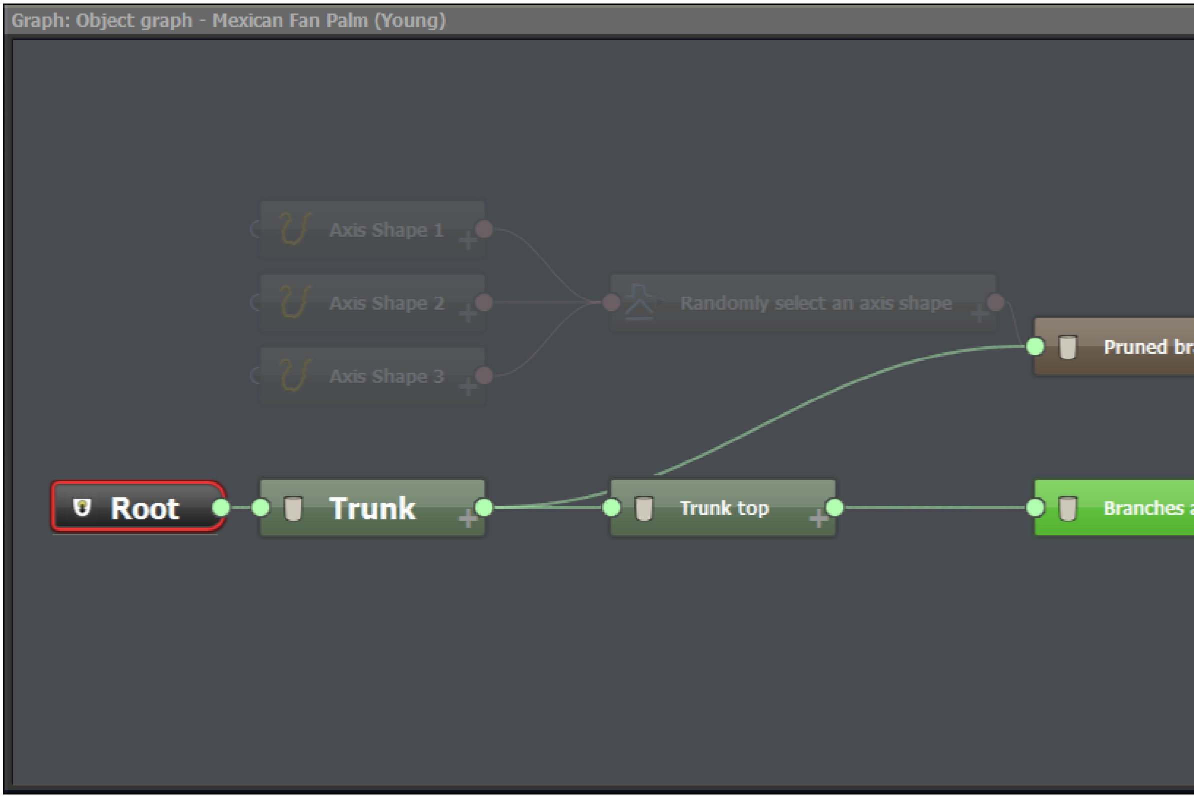
The same node parameters are used to generate all primitive instances of one color. That's why the procedural edition is powerful. But with manual edition, you can individually select and edit primitive instances for plant tweaking and finalization.

Graph

A graph is a set of interconnected nodes that are used to generate output values based on the values of a given set of inputs.

Plant Factory makes use of two types of graph :

- vegetation graph that describes the plant structure
- material graph



Input and Output Nodes

The graph inputs sit on the left of the graph. The graph outputs are placed on the right of the graph. Input nodes are the points where data enters the graph, and output nodes the points where the data exits the graph. Output nodes represent the value that is computed by the function.

Data enters the graph at the input nodes, flows down through the different nodes and links in the graph, and exits at the output node. You cannot place other nodes at the left of the input nodes or at the right of the output nodes.

Vegetation Graph

In Plant Factory, the main graph may contain vegetation nodes in addition to the standard nodes. Those nodes are being evaluated starting from the Plant root on the left and following the links. Evaluating vegetation nodes causes geometry to be build.

Unless for vegetation components, there is no output to this graph, since its purpose is not to yield a result value but to generate the plant structure.

Node

Nodes are represented by little boxes on the graph. A node receives a flow of data on its entries, affects a certain processing on that data according to its type and the values of optional parameters, and generates one or several flows of outgoing data. This outgoing data can be of the same type as the incoming data, or it can be of a different type.

The **size** of the nodes is defined automatically but you can change it by clicking on the node top-right corner and dragging. That way you can make important nodes stand out by making them larger than the other ones.

It is possible to change the display **color** of any node (or groups of nodes) on the graph to improve readability. Just select the node; under the preview of the node there is a color box. Click on it to open the Color Selection and select a display color for that node.

For the complete list of nodes, please refer to this page.

Link

Links are the lines that connect different nodes together. Links represent the flow of data through the graph. The data flows towards right, from left (inputs) to right (outputs).

The color of the link indicates the type of data that is being transported by the link:

- **Blue link**: number (e.g. noise output),
- **Bright green link**: color information,
- **Purple link**: texture coordinates,
- **Red link**: vector data (e.g. position),
- **Pale green link**: vegetation,
- **Gray link**: undefined data type.

When a link is selected (e.g. by clicking on it), it is drawn with a thicker line.

Type of Data

The nodes in the Function Editor can process 5 different types of data:

- **Number:** this is a floating point value. It is the typical output of a function graph. Noise nodes and Fractal nodes (among others) produce numbers.
- **Color:** this is the typical output of the color nodes. If you are editing the Color channel of a material, the function may either output a number (in which case the number will be converted into a color outside of the function using a color map), or directly output a color.
- **Texture Coordinates:** this is a two-dimensional vector that typically indicates the texture coordinates of the point where the function is being evaluated. This is the typical output from the Projection node.
- **Vector:** this is a set of 3 numbers that indicate a position or a direction in space. Typically, the position and normal inputs are both vectors, where position indicates the position of the point where the function is being evaluated (converted into the appropriate coordinate system depending on the selected mapping mode), and where normal is the direction in which the surface of the object is pointing, at the point where the function is being evaluated.
- **Vegetation:** this is a special type of data for the main graph of Plant Factory. Unlike the above types it doesn't carry any value. It is used to build links between vegetation nodes to reflect the plant hierarchical structure. Featuring this type of data allows Plant Factory to merge plant structure with nodes used for numerical parameters into a single graph.

Questions and Answers

What changes were made to the TPF EULA in Release 2014.6?

You can read the changes here: TPF 2014.6 EULA

How can I share content I make with PlantFactory?

- **If you want to give away content to others:**

You can share your content for free by uploading it to the Cornucopia3D Exchange Area under the .tpfc3d format.

- **If you want to give a TPF file to a friend:**

You can send a TPF file to a friend privately through Cornucopia3D, using the menu command ***File | Export | Send To A Friend*** in the application, even if you don't have Producer (only Producer can exchange assets directly). Your TPF file will be uploaded to a private exchange area on Cornucopia3D, and you will be provided with a link to send to your friend so that he or she can download the item there. Your friend will be able to use your item in his/her e-on software products (PlantFactory, VUE, CarbonScatter or LumenRT). You are only allowed to share non-commercial work this way.

- **If you are using Producer:**

If you are using TPF Producer, you can share .tpfp files with other TPF Producer, VUE, CarbonScatter or LumenRT users in your facility (e.g. if your studio owns 2 licenses of TPF Producer, you can exchange assets freely between both licenses), or as part of a commercial contract (i.e., if you own Producer and you are contracting for a studio that also owns Producer – see below).

- **If you are a Cornucopia3D vendor:**

You can upload your content to your Cornucopia3D vendor account, in .tpfc3d format, and sell it or give it away there.

Can I sell the content I make with PlantFactory?

- **If you are doing commissioned work:**

If you are contracting for a third party, you are allowed to sell rigged or animated content to them, on a one-to-one basis as part of your contract, either in the native .TPFP Producer format or in standard 3D formats (e.g. FBX, OBJ...), including rigged and animated meshes. However, any such sale must be unique and final. If you sell your content, you must transfer to your client all use and ownership rights and titles legally transferable. After the transaction, you are strictly prohibited from using, selling or giving your content to anybody else. Obviously, you must also ensure that you have all rights to the content you are handing over – typically, you are not allowed to provide them content that you purchased separately, even if it was modified by you.

- **If you are making content that you want to give or sell publicly:**

You are free to give or sell the static meshes that you create with PlantFactory anywhere you like, at the price you like. In return, we ask that you identify clearly that your content was created with PlantFactory, both in the name (it must start with *"PlantFactory"* or *"TPF"*) and in the description (it must mention *"Created using e-on software PlantFactory"*). You must also make available the source PlantFactory file on Cornucopia3D for a comparable price (up to 1.5 times the lowest price you sell the static meshes for – this pricing policy does not apply to items given away by you). You are not allowed to give or sell rigged or animated meshes created with PlantFactory, even if they were modified in another application. Please refer to the EULA for conditions.

What version of PlantFactory do I need in order to sell plants?

You can use PlantFactory Artist, Designer, Studio or Producer.

Can I distribute my content inside an application (e.g. a game)?

Yes you can, provided that the content is yours, that it is distributed in proprietary format, that you ensure that it cannot be extracted from the application, and that you credit Plant Factory appropriately.

My company has multiple copies of VUE running on many different machines. Can my single copy of PlantFactory Producer save TPF files that can be used on all these VUE copies?

Yes, content created with PlantFactory Producer can be used on all copies of VUE Infinite and xStream in your facility. Other versions of PlantFactory do not allow this, however.

Can I network-render VUE scenes that include plants I create with PlantFactory?

Yes, but this requires the Producer version of PlantFactory. Producer is required for any form of network rendering (using RenderCows or RenderNodes) of VUE scenes that contain plants you create yourself.

Can I use plants purchased from Cornucopia3D in my VUE scenes, and then network-render them?

Yes you can, provided that you don't modify the plants in PlantFactory. This is also true of the content that ships with PlantFactory. However, if you wish to edit the plants and then do network-rendering, you will need Producer.

What are the different file formats used by PlantFactory, and what do they do?

For a discussion of the different file formats, please refer to this page.

Tutorials

Official Videos

Third Party Videos

GeekatPlay

PlantFactory Exporter

PlantFactory Exporter is a specialty version designed for CG artists using any 3D application (such as 3DS Max, Maya, Cinema 4D, Softimage, LightWave, Modo, etc).

This very simple version of Plant Factory gives you the following capabilities:

- you can browse the vast library of Plant Factory assets and purchase exactly the plant species you need
- generate variations of these plants with the click of a button
- adjust global settings such as age, season and health.
- tweak any parameters that were published in the plant species
- modify level of detail at will
- export the plant and its variations as static 3D meshes for use in other 3D applications.

Using the Product

Menus

File

- **Open:** displays the browser to select a plant.
- **Import Mesh:** this imports a mesh.
- **Delete Imported Meshes:** this deletes any imported meshes.
- **Export As Standard Mesh:** exports the current mesh. Opens the Export Options dialog for you to select the file format, file name, and other parameters.
- **Export As VUE Mesh:** this option bakes the plant into a mesh then exports it in Vue Object format (VOB). This can be helpful to optimize rendering of your plant but you will not take advantage of TPF rendering technology.
- **Options:** displays the **Options panel**.
- **Exit:** closes The Plant Factory Exporter.

Tools

The Tools menu is a list of the options in the Toolbar.

- **New Plant Variation:** click to create a new variation of the displayed plant

- **Show Information:** shows information about the currently displayed plant, such as, number of polygons, number of billboards.
- **Show Ruler:** shows the ruler for scale checking.
- **Zoom Entire Plant:** makes the plant fit the preview
- **Subdivide More:** shows more detail
- **Subdivide Less:** shows less detail
- **Interface Colors:** displays the Interface Colors dialog for any modifications you might want to make.

Window

- **Toolbar:** this option displays the Toolbar.
- **Panel:** this option displays the Properties Panel. See below.

Help

- **Overview:** displays the TPF Help wiki for more product information.
- **About The Plant Factory Exporter:** displays the current build number and Installation code (INST-)

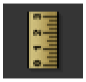
The Toolbar

Exporter Toolbar

- 

  Export Plant: with a plant loaded in the interface, click to export a plant, opening the Exporter dialog
- 

  New Plant Variation: click to create a new variation of the displayed plant

- 

  Show Ruler: shows the ruler for scale checking.

- 

  Show Information: shows information about the currently displayed plant,such as, number of polygons, number of billboards.

- 

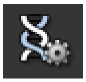
  Zoom Entire Plant: makes the plant fit the preview viewport.

- 

  Subdivide Less: shows less detail.

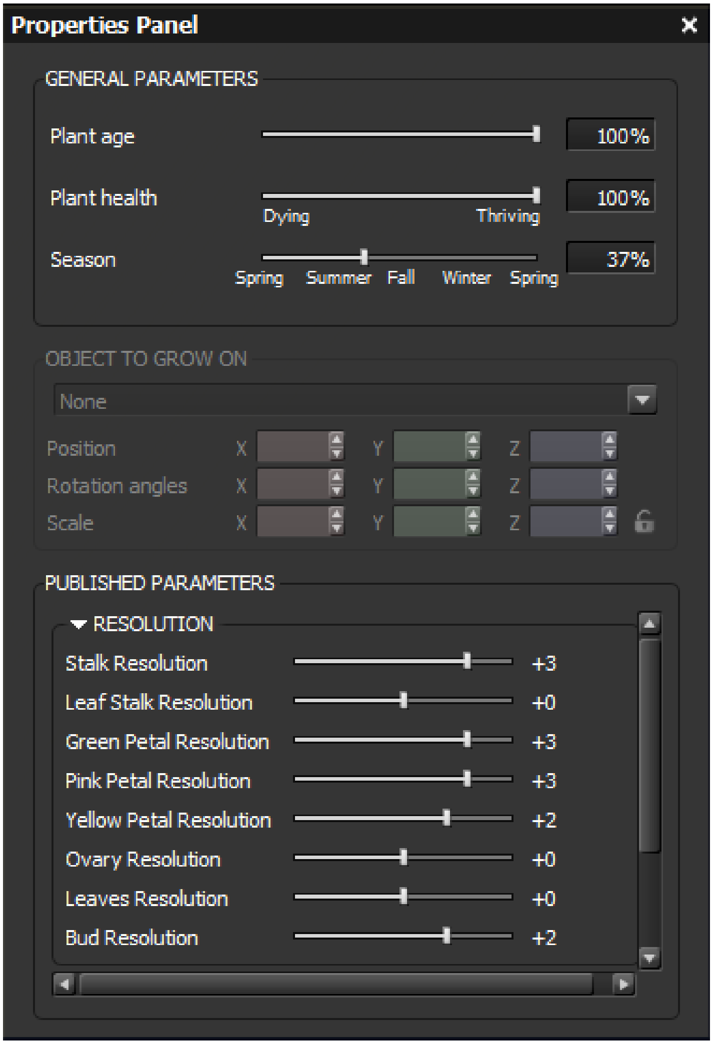
- 

  Subdivide More: shows more detail.

- 

  Properties Panel: displays the Properties Panel.

The Properties Panel



Properties Panel

If the plant depends on age, health or season, you can control these parameters from here.

If the plant displayed is attached to an object, the fields in the lower part of the panel are available so that you can modify the Position, Rotation angels and Scale of the object.

If the plant has published parameters, they may be tweaked here.

PlantFactory 2014 Compatibility Issues

Because of some new features of PlantFactory 2015, there may be some compatibility issues with your PlantFactory 2014 files

Wind

The wind algorithms have been completely redesigned in PlantFactory 2015, up to the point that there is no way to translate wind effects designed with earlier versions of PlantFactory. As a result, the wind effects of the plant you are loading will not look the same as in PlantFactory 2014. At loading of PlantFactory 2014 files, three choices will be offered: removing all wind effects, keeping the current wind settings or using default wind settings. Of corse, in all cases, you will be able to modify wind effects using the updated wind algorithms.

Blending

Blending based on subdivision surfaces have been introduced in PlantFactory 2015. For a coherency matter, we had to move the old Blending parameters from the child node to the parent node and make it common with the new Blending parameters. Unfortunately, compatibility between old settings and new settings is impossible. If your plants used blending configured with earlier versions of PlantFactory, blending will be still visible but not editable in PlantFactory 2015. If you want to change your blending settings, you will have to use the new sets of parameters and configure your settings from scratch.

What Changed in the EULA

Here is an explanation in plain vanilla English of the changes that were made to the PlantFactory EULA since release 2014:

- You are now free to give or sell the static meshes that you create with PlantFactory anywhere you like, at the price you like, provided that you advertise the fact that your meshes were created with PlantFactory , and that you sell the source file on Cornucopia3D. Check the frequent questions here.
- You can now easily send a TPF file to a friend privately through Cornucopia3D, using the menu command ***File | Export | Send To A Friend*** in the application. You are only allowed to share non-commercial work this way.
- You can share your content freely with others using the Exchange Area at Cornucopia3D. You don't need a vendor account to do so.
- PlantFactory now allows you to sell the plants you create with PlantFactory to a client, even if your client doesn't have PlantFactory (that includes rigged and animated meshes). But you're only allowed to sell (or give) your content to one person/entity, and once you have done that, you cannot use, give or sell that content anymore. Your client can use the content internally, but is not allowed to distribute it either, except as part of a pre-packaged application – see below.
- You, or your clients, are allowed to distribute content created with the PlantFactory provided that the content is part of a pre-packaged application (typically a game) and that the content is in a proprietary format that no-one else can read and cannot be easily extracted.
- You can give the new FBX import scripts to your clients together with your content, to help them import and setup the FBX inside their applications.

Questions? Take a look at frequent questions here.

In case of doubt, the PlantFactory EULA is binding; please see here for the exact terms of the EULA.

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You may not alter, modify, translate or adapt the Product. In addition, you may not de-compile, disassemble or reverse engineer the Product. You also may not create any derivative works based on the Product. A derivative work is defined as a translation or other form in which the Product may be recast, transformed or adapted.

Content and Content Limitations

You may, without limitation, use any content you create with the Product in the other computer graphics programs in your facility to create images and animations provided that the images and animations produced are not used to create content files (for instance but not by way of limitation 2D billboards, picture tubes, or alpha background planes) for distribution or sale.

You may sell or distribute content that you create using the Product to multiple third parties in generic 3D computer graphics formats (such as but not by way of limitation .VOB, .VUE, .OBJ, .3DS, .C4D, .FBX), under the express condition that (i) you do not include any rigging or animation information in said content, (ii) said content is always identified solely as “PlantFactory XXX” or “TPF XXX” where XXX is the name you wish to give to the content, (iii) you state “Created using e-on software PlantFactory” in any and all description of said content, (iv) you make available on the Cornucopia3D content store, subject to the terms and conditions of Cornucopia3D and e-on software, any and all native Product files required to generate said content, for free or for a fee that is no more than one-and-a-half (1.5) times the lowest fee charged by you or any third party for said content, (v) you create said content entirely yourself and do not use any sample content provided with the Product, (vi) you do not infringe on the copyright and terms of use of any items you acquire separately and (vii) the content is not distributed as part of an application. It is your responsibility to ensure that all foregoing requirements are met. If you would like to sell or distribute, for free or for a fee, content you created with the Product through a third party, but said third party’s requirements conflict with the requirements set forth in this agreement, you are not allowed to sell or distribute your content through said third party. The foregoing requirements also apply to any derivative work created using the content and distributed, for free or for a fee, by you or by any third party. For example but not by way of limitation, if you create content using the Product and modify said content using other software, the above requirements remain in force, whatever the extent of the modifications made in the other software. No terms of service or service agreement by any third party whatsoever shall ever be construed as expanding your rights, reducing the scope or voiding any requirement set forth in this agreement. If you are unable to make available the native Product files on the Cornucopia3D content store as indicated in requirement iv above, for whatever reason whatsoever, any and all rights granted herein to sell or distribute content in generic 3D formats shall immediately be revoked. Any infringement of the foregoing shall be deemed a violation of e-on software's Intellectual Property.

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Exchanging native files between licenses of the Product is only allowed with the Producer version. You may, however, use the Product's integrated file sharing feature (Send to a Friend) to send non-commercial files to another user of a non-Producer version of the Product. Using said feature for transferring commercial work is strictly prohibited and any such transfer of such work or any commercial use of content transferred using said feature shall constitue a violation of e-on software's Intellectual Property.

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