

OnyxTREE™ BAMBOO

Manual 6.0



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Onyx Computing, Inc.

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OnyxTREE BAMBOO 6.0

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Introduction

- Individual bamboos
- Continuous growth of bamboos
- Bamboos in grove

OnyxTREE BAMBOO referred further as BAMBOO in this manual, is **the first parametric generator that models photorealistic single culm bamboos, bamboo groves and bamboo growth**. Once a bamboo has been generated, you can save it as a parametric BMB file in a custom library of bamboo parameters and as a single 3D model or growth sequence of 3D models in 3DS, C4D, DXF, FAC, LWO, OBJ, or W3O file formats.

Those who inquire about BAMBOO may be confused in thinking that BAMBOO is only a library of bamboos. It is very important to clarify this misconception. Although, **BAMBOO package comes with a library of pre-modeled bamboos**, this program is neither a data library nor a procedural library of bamboos.

BAMBOO is a true bamboo creator that allows you to model virtually any kind of bamboo thanks to the powerful parametric modeling technique that the program implements. The beauty of parametric modeling lies in the presence of precoded knowledge about the anatomy and growth of a bamboo you are going to model so that you do not have to start from scratch as is the case with conventional modeling.

With BAMBOO, you model a bamboo by simply manipulating its essential characteristics - parameters - such as the culm height, the curvature and density of branches, the type and color of foliage, growth speed, and



many more. **By adjusting the values of parameters, you can model a broad range of bamboos - different species, variations of the same species, and bamboos in different stages of growth.** Each parameter adjustment is recorded on the model instantly followed by updated pre-view, so that you have full awareness of the changes during the modeling process.

User Interface

In spite of numerous parameters, it is very easy to command BAMBOO because of its extremely well thought user interface. **The bamboo parameters are logically grouped and can be easily accessed on different levels of modeling detail.** The levels of modeling detail (or abstraction) allow you to concentrate on one class of bamboo elements at a time which, taking into account an inherent complexity of bamboos, helps tremendously in the modeling process.

The user interface is structured to reflect clearly the BAMBOO's internally encoded very complex principles of modeling so that you can get an understanding of these processes and achieve easily complete control. For all these years of our software developments, we have striven to make the communication between the user and our vegetation creators so fluent that, in the user's mind, it looks as if the interface has almost disappeared.

Meet the Current Technology

A good program is distinguished not only by its features, but also by how well does the program balance its performance with the current technolo-

gy. This is of particular importance for modeling bamboos and plants in general since high demands on processing power and memory space tend to push a computer to its limits. We have invested tremendous amounts of time and energy in the research to achieve this balance and to make BAMBOO truly functional and useful.

BAMBOO can save a created bamboo as a parametric model and as a 3D geometric model depending on the way you wish to use the data. In the parametric model, the bamboo is described by a set of parameters whose values determine its characteristics. **BAMBOO parameter file is almost like a DNA file of the bamboo.** The bamboos saved in a parametric form will take the least space thus making it the ideal format for creating and expanding ever growing bamboo library. Besides its compact size, the parametric format allows you to create infinite variations of a master bamboo or bamboo grove that will depart slightly or substantially from its original. A parameter file can be opened by BAMBOO which then generates the bamboo's 3D geometry according to the instructions written in the file.

The BAMBOO's 3D polygonal models are exported in 3DS, C4D, DXF, FAC, LWO, and OBJ file formats. When creating a 3D model, BAMBOO gives you complete control over the size of the model. For a given BAMBOO, the number of polygons can be adjusted, so that you can achieve the best compromise between the model's size and the level of detail shown without sacrificing the bamboo's look and feel. Even with the small number of polygons, our models preserve graciousness of natural bamboos.

The combination of temporal parametric modeling and different export formats makes BAMBOO the ultimate bamboo creator which



successfully balances today's constraints of the computer processing power, and, at the same time, reaches far beyond the current state of technology into the future.

WIN Minimum System Requirements

- Computer with Intel Pentium or equivalent processor
- 10 MB of RAM
- 30 MB of disk space
- 800 x 600 pixels, 24-bit color display support
- Windows XP/2000/NT/ME/98/95 operating system

MAC Minimum System Requirements

- 10 MB of RAM
- 30 MB of disk space
- 800 x 600 pixels, 24-bit color display support
- MacOS X operating system

Registration

OnyxTREE BAMBOO requires a password. Please follow the registration procedure written in Registration.rtf file.

Installation

Installation of OnyxTREE BAMBOO package is a simple process. Please follow the installation procedure written in Installation.rtf file.

Technical Support

To ask a technical question, please send email to:

Support@OnyxTREE.com

The subject line must contain the BAMBOO serial number and the registrant name. The question must be clearly stated and supported with a parameter file and/or screen image if necessary. We will do our best to respond to you in a timely manner. The inquiries that do not contain the BAMBOO serial number and the registrant name will not be responded to.

H 1.81 m S 1.45 m A 0° E 0°



C B1 B2
P F



Y M D h m
0 0 0 0 0



Bambusa multiplex

3

Random Seed "

200 cm

Length "

10mm

Width

Node

200mm

INode Length "

3 °

Angle "

0 °

Twist "

Curving

Color

Growth

Licensed to:
Bojana



Send

Cancel

OnyxTREE BAMBOO Controls Overview

BAMBOO window is divided into four areas:

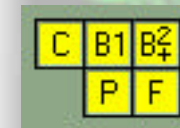
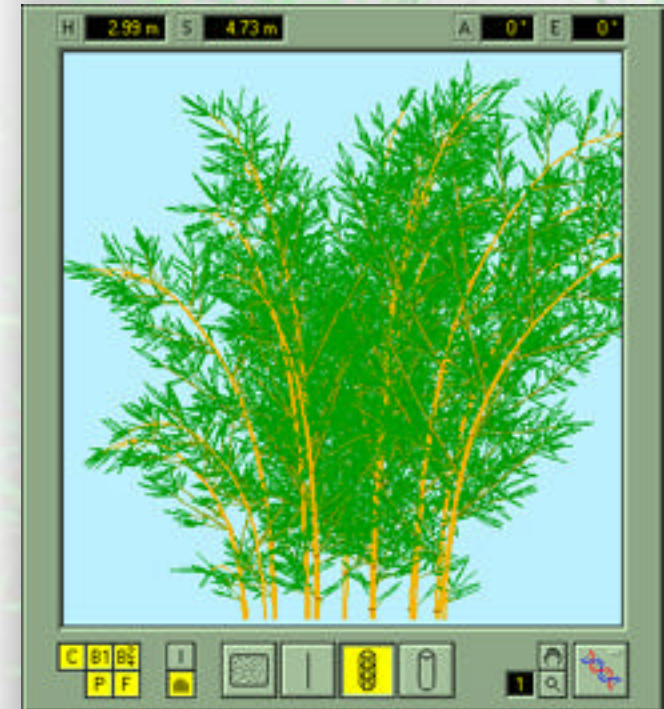
- Preview Panel in the central left part of the window
- Parameters Panel on the right
- Growth Time Panel in the lower left area of the window
- Communication Panel in the lower right area of the window

Preview Panel - Preview Panel consists of the canvas on which the rendering occurs and a set of buttons and displays.

Element Selection - The leftmost group of five buttons at the bottom called **Structural Abstraction** buttons enable you to preview a bamboo at various levels of detail. The letters on these buttons designate different classes of bamboo elements. **C** (culm), **B1** (branches of the first generation), **B2+** (branches of the second and subsequent generations), **P** (petiole), and **F** (foliage - leaves).

If you wish a bamboo previewed in full detail, select all the buttons. By deselecting any of the buttons, the bamboo will be displayed without the corresponding class of elements. Such selective viewing of the model speeds-up the design process tremendously because one is able to see only those parts of the model that are of interest at the particular moment.

Grove Selection - There are two buttons here: **Single Bamboo** (the top button designated with the “single culm” icon) and **Bamboo Grove** (the button underneath “Single Bamboo” designated with the “multiple culms”



icon). If “Single Bamboo” is pressed then BAMBOO displays single, representative bamboo in a grove. If “Bamboo Grove” is pressed then the whole bamboo grove will be displayed.

Preview Selection - The three large buttons in the middle allow you to select the preferred display mode. You can choose to preview a bamboo in **Linear**, **Wireframe**, or **Full-shading** rendering mode. Also, if “Bamboo Grove” button is pressed then the fourth, **Schematic Grove** button will show up to the left of the “Linear” button. The “Schematic Grove” button, when pressed, commands BAMBOO to display a schematic representation of bamboo grove. The “Schematic Grove” display mode is most suitable for viewing during grove creation process.

The rightmost group of preview buttons includes **Zoom**, **Drag**, and **Create/Render** buttons.

Zoom (designated with a magnifier icon) allows you to zoom-in and to examine a bamboo in detail. When you press the “Zoom” button and position the cursor anywhere on the BAMBOO's canvas, you will see the cursor changing to a magnifier with a plus sign. Press the mouse to zoom-in on a specific part of the bamboo. To zoom-out, hold the Option key and press the mouse. Please note that when the zoom level is higher than 1 (one), Auto Scale is inactive. Auto Scale will become active again when you zoom all the way out. The display on the left of the “Zoom” button shows the current zoom level or magnification factor.

Move (designated with a hand icon) activates the translate mode which allows you to grab and move a bamboo. When you press the “Move” button and position the cursor anywhere on the BAMBOO's canvas, you will see the cursor changing to a hand. Press the mouse and drag the bam-



boo in any direction.

Create/Render (the rightmost button in the group, designated with the “DNA” icon), when pressed, initiates the creation and rendering. Note that the rendering is initiated also whenever you switch to a different rendering mode or select/deselect any of the “Structural Abstraction” buttons. The rendering can be stopped by clicking the mouse anywhere in the content area of the window, including the buttons.

Bamboo Height and Crown Spread - Above the canvas there are four displays. The two displays on the left designated as **H** (height) and **S** (spread) show the height and spread of the currently created bamboo or bamboo grove in meters. The display is also active when any of “Growth Advance” buttons are ON.

Eye Position - The **A** (azimuth) and **E** (elevation) displays on the right show the elevation and azimuth angles of the current viewpoint. The elevation angle is the angular distance of the eye from the horizontal plane. The azimuth angle is the horizontal angular distance of the eye from Y axis.

Rotational Cursors - You can change the viewpoint by positioning the cursor anywhere on the BAMBOO's canvas, pressing the mouse and moving the cursor to the left, to the right, upwards, or downwards.

As you start moving to the left, for example, the cursor will change to a left arrow, the bamboo will rotate clockwise around Z-axis (which is the principal direction of the culm growth), and the “A” display will continuously update the azimuth angle. If you change the direction of movement from left to right, the cursor changes to a right arrow and the bamboo



rotates counter clockwise.

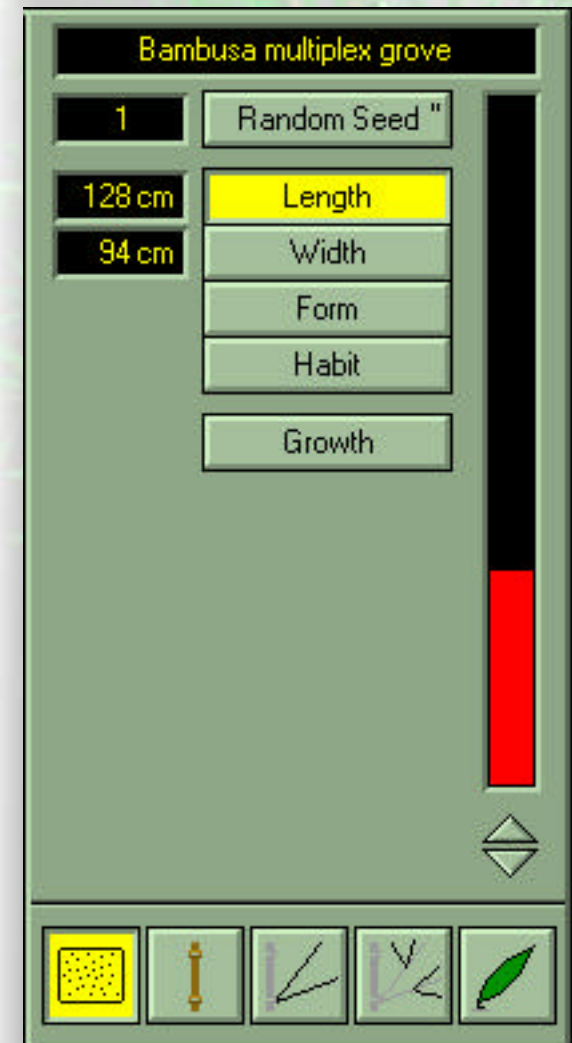
By pressing the mouse and moving the cursor upwards, the cursor will change to an upward arrow, the bamboo will rotate around the axis lying in the XY plane (ground plane), and the “E” display will continuously update the elevation angle. If you change the direction of movement from upwards to downwards, the cursor changes to a downward arrow and the bamboo rotates in the opposite direction.

If you hold the Option key while you are moving the cursor, the bamboo will rotate in both directions simultaneously, and the “A” and “E” displays will be continuously updated.

- 000 -

Parameters Panel - Parameters Panel has two sections. The upper section has the **Bamboo Name** display, the **Bamboo Parameter** buttons and their current value displays, and the master slider that enables you to change these values. Not all of the parameters that describe a bamboo are displayed at the same time. They are grouped in five main groups: **Grove Parameters**, **Culm Parameters**, **Branch1 Parameters**, **Branch2+ Parameters**, and the **Foliage Parameters**. These groups are represented by large **Group Level** buttons in the lower section of the “Parameters Panel”. They set the associated groups of “Bamboo Parameters” to be the currently active and visible.

In the “Group Level” row, the first button enables you to access the individual parameters that describe the bamboo grove. The second button accesses the parameters of bamboo culm. By pressing the third button, you can access the parameters that control branches of the first generation. The fourth button accesses the parameters of the second and suc-



cessive generations of branches. And the fifth button accesses the parameters of bamboo leaves.

The parameter buttons with double quotation mark (“) at the top right hand corner, as, for example, Random Seed, have associated sub-group of parameters and these parameters can be accessed by double clicking the corresponding parent button. The parameter buttons without the window display of their current values as, for example, Growth, serve only as access buttons to the associated sub-group of parameters.

Name Display shows the name of the current bamboo which is the name of the BMB parameter file this bamboo resides in. The name of BAMBOO's parameter or object files can be 255 characters long and is limited by the operating system. However “Name Display” will show up to 34 characters without showing BMB file extension. When naming the file, we suggest not to use all capital letters. If any of the parameters of the currently shown bamboo have been modified, a red dot will appear in the upper right corner of “Name Display” indicating that the change has been made and that the changed bamboo should be saved under new name.

BAMBOO can create virtually infinite number of different bamboos. There is a vast exploration space in front of you. The key to using BAMBOO most effectively is acquiring a good grasp of its behavior. Begin by playing with the software. Once you comprehend the effects that a parameter or group of parameters have upon a bamboo, it is much easier to define purposeful actions that will lead to desired results. Here are some tips for making your exploration of BAMBOO more productive:

1. Use the bamboos from BAMBOO Library as templates. It may be easier to grasp BAMBOO's behavior by changing a bamboo's template than



by starting from scratch.

2. Concentrate on one group of parameters at a time. Explore the Culm and Branch1 parameters first, and pretend for now that the rest of the parameters do not exist. Once you master those proceed to other parameter groups.

3. Examine the parameters in the linear mode. The linear mode is the fastest, and it shows most clearly how a parameter affects the bamboo structure.

4. Read BAMBOO Parameters chapter. It will give you better understanding of the parameters and how they work.

5. Take a photograph of a bamboo and try to model the same bamboo by visually referencing the photograph. For most of us, it is easier to model a bamboo by copying it from the photograph than by visualizing it in our heads.

- 000 -

Growth Time Control Panel - Growth Time Control Panel consists of:

Growth button

Time Sampling Interval buttons

Year, Month, Day, hour, minute

Age display

YYY, MM, DD, hh, mm

Growth Advance buttons

Jump to Beginning, Reverse Step, Reverse,



Stop,
Forward, Forward Step, Jump to End
Qualitative Age Line bar

Growth button, when pressed, enables you to use “Time Control” functions. If the “Growth” button is on and you change any parameter value, for example culm “Length”, the “Growth” button pops out and the canvas is updated with a fully grown bamboo as affected by that change. To pre-view this bamboo at a specific time of growth, press “Growth” button again and then press “Create/Render” button.

Time Sampling Interval buttons are: year [Y], month [M], day [D], hour [h], and minute [m]. They work in conjunction with “Growth Advance” buttons and allow you to view bamboo growth in different time intervals. If you wish to advance growth in one month intervals, for example, press month [M] button and then press “Forward” button.

Age Display is located below the “Time Sampling Interval” buttons. It shows the current age of a bamboo or bamboo grove in YYYY - MM - DD - hh - mm time format. You can specify the age by entering the numeric values in the “Age Display” text boxes. Press “Create/Render” button to view a bamboo or bamboo grove at this particular age.

Growth Advance buttons enable you to view bamboo growth. There are seven controls in that group:

Jump to Beginning - brings you to the beginning of growth.

Reverse Step - steps back in time for one time interval.

Reverse - continuously steps back in time at the given interval rate until



it reaches the beginning of growth. Reverse growth can be stopped at any time by pressing the “Stop” button.

Stop - Stops forward and reverse growth.

Forward - continuously steps forward in time at the given interval rate until it reaches the terminal growth state. Forward growth can be stopped at any time by pressing the “Stop” button.

Forward Step - steps forward in time for one time interval.

Jump to End - brings you to the end or terminal growth state.

Age Line bar under the “Growth Advance” buttons gives you a qualitative information about the currently displayed bamboo’s age. You can see where on the time line does the currently displayed bamboo lay.

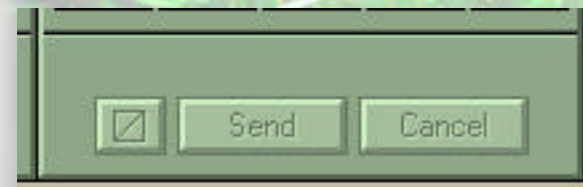
- 000 -

Communication Panel - Communication Panel consists of:

- Status field
- Polygons button
- Send button
- Cancel button

Note that Communication Panel is active when OnyxTREE BAMBOO modeler is linked to OnyxTREE STORM plugin for EI Universe. When this link is not established, Communication Panel elements are grayed-out.

Status Field displays “Universe Connected” when OnyxTREE BAMBOO is linked to OnyxTREE STORM plugin for EI Universe.



Polygons button, when pressed, opens up Adjust Polygons and Detail window where you can set up modeling detail, resolution, units, etc. prior to sending a tree model to OnyxTREE STORM. These controls are, in essence, the same as Save As FACT window. Thus to find out about its features, go to page 123 and read FACT File Export.

Send button, when pressed, sends a tree model to OnyxTREE STORM.

Cancel button, when pressed, cancels any changes made in OnyxTREE BAMBOO and returns the control to OnyxTREE STORM.



What is on the Menus

Menu bar holds 5 menus (Win only), 6 menus (Mac only):

- OnyxTREE BAMBOO (Mac only)
- File
- Edit
- Background
- Special
- Help

OnyxTREE BAMBOO menu (Mac Only)

OnyxTREE BAMBOO > **About BAMBOO...** - Brings up the title screen.

OnyxTREE BAMBOO > **Hide OnyxTREE BAMBOO...** - Hides the main window.

OnyxTREE BAMBOO > **Quit OnyxTREE BAMBOO...** - Quits BAMBOO application.

File menu

File > **Load Parameters...** - Opens a selected BMB file and loads its parameter values into BAMBOO modeler.

File > **Save Parameters...** - Saves current bamboo parameter values on a disk as BMB file.

File > **Save Model as 3DS...** - Saves a single bamboo or growth sequence into a specified 3DS file or sequence of files. See the chapter

3DS Model for detailed description.

File > **Save Model as C4D...** - Saves a single bamboo or growth sequence into a specified C4D file or sequence of files. See the chapter C4D Model for detailed description.

File > **Save Model as DXF...** - Saves a single bamboo or growth sequence into a specified DXF file or sequence of files. See the chapter DXF Model for detailed description.

File > **Save Model as FAC...** - Saves a single bamboo or growth sequence into a specified FAC file or sequence of files. See the chapter FACT Model for detailed description.

File > **Save Model as LWO...** - Saves a single bamboo or growth sequence into a specified LWO file or sequence of files. See the chapter LWO Model for detailed description.

File > **Save Model as OBJ...** - Saves a single bamboo or growth sequence into a specified OBJ file or sequence of files. See the chapter OBJ Model for detailed description.

File > **Quit** - Quits BAMBOO application (Win only).

Edit menu

Edit > **Copy** - Copies bamboo image from the canvas onto the clipboard.

Background menu

Background > **Sunny skies blue** - Sets the background color to R187, G240, B255.

Background > **New England blue** - Sets the background color to R15,



G201, B255.

Background > **Joshua desert beige** - Sets the background color to R201, G170, B114.

Background > **Woodlands green** - Sets the background color to R30, G100, B10.

Background > **Overcast** - Sets the background color to R153, G153, B153.

Background > **White** - Sets the background color to R255, G255, B255.

Background > **Black** - Sets the background color to R0, G0, B0.

Background > **Other...** - Pick your custom color.

Special menu

Special > **Auto Draw** - If checked, then the rendering is auto-initiated after each parameter adjustment.

Special > **Auto Scale** - When checked, Auto Scale fits the image to the BAMBOO's canvas. The scaling factor for the bamboo image is auto-adjusted to that of the last bamboo image. If unchecked, the scaling factor is constant and has the value of the last bamboo image rendered with Auto Scale checked.

TIP *If you want to see the whole bamboo on the canvas do the following:*

1. *set Zoom to 1*
2. *set Auto Scale to active*
3. *press Draw button and wait for it to bounce back*
4. *press Draw button again*

Result -- the whole tree is being redrawn and fits the canvas.

Special > **Reset View** - Sets the bamboo image into default position on the canvas. For this to work, Zoom level must be at 1. It is applicable only if the bamboo has been dragged around the canvas by “hand”.

Special > **Default Bamboo** - Sets the parameters of “Default” bamboo to be the currently active parameters. If you are creating a bamboo from scratch, we recommend you to choose “Default” bamboo as a starting point.

Special > **Bambusa multiplex** - Sets the parameters of “Bambusa multiplex” bamboo to be the currently active parameters.

Special > **Continuous Update** - If checked, the bamboo image will be continuously updated as you rotate (change the viewpoint) or drag the bamboo. This will work only with smaller bamboos and on fast computers. As the technology progresses further and computers become more powerful, this feature will become much more useful.

Help menu

Help > **Manual...** - Starts Adobe Acrobat Reader and displays this manual's title page.

Help > **Bamboo Nursery...** - Starts a web browser and displays the OnyxNursery bamboos chapter web site.

Help > **OnyxTREE Web Site...** - Starts a web browser and displays www.OnyxTREE.com web site.

Help > **Email Us...** - Starts an email application.

Help > **About BAMBOO...** - Displays the BAMBOO's title screen (Win only).

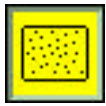
BAMBOO Parameters

In this chapter we will cover five sections of Bamboo parameters:

- Grove parameters
- Culm parameters
- Branch1 parameters
- Branch2+ parameters
- Foliage parameters

Things to Know About Bamboo

Bamboos are evergreen plants, a subfamily of grasses of *Gramineae* family (alternatively *Poaceae* family). They grow in groves or clusters. It can be said that a bamboo grove is a family of bamboos growing within certain area of land that share the same rhizome. A bamboo rhizome is an underground branching structure that allows the bamboo to spread and it produces culms which grow above the ground. A culm is the main stem of a bamboo. It is a structure of nodes and internodes wrapped by sheaths which protect them and supply them with hormones for their growth. A node is a branch producing part of the culm. An internode is a part of the culm between two adjacent nodes. Bamboo branches grow in clusters from buds located on the nodes. The branches are built in similar way as the culm. Both, the culm and the branches, carry leaves. A bamboo leaf develops from a leaf sheath that encircles and protects the nodes of the upper part of the culm and the branches. It is attached to its sheath by a short stalk like structure we call a leaf petiole which enables the leaf enormous flexibility in movements depending on the environmental circumstances.



Grove Parameters

BAMBOO grove is an area within which one or many bamboos grow.

BAMBOO grove parameters are activated by pressing the Grove button - the first out of five buttons in the Group levels section. That brings up the following top level and subsequent level grove parameters:

Random Seed "

Randomize...

Bamboo

Grove

Growth

Length

Width

Form

Length

Width

Rounding, R/B

Aching

Habit

Min. culm spacing

Rhizome inode (internode) length

Random change, UL/L

Rhizome inode (internode) angle

Random change, UL/L

Rhizome starts at

Grove fill

P (partial)

F (full)

Show grove grid

Show rhizome branching

Growth

Group level buttons



Random change, UL/L
Speed

- 000 -

Random Seed parameter enables you to create different instance of the same bamboo by changing its value [1...1000]. On double click, it brings up Random Seed window with three parameters that randomize the bamboo, the bamboo grove, and the bamboo growth. This window is accessible on all five Group levels, i.e. Grove, Culm, Branch1, Branch2+, and Foliage level.

Randomize **bamboo** is a global parameter that simultaneously sets the values of all bamboo random parameters [0...100%]. When set to 20%, for example, it automatically adjusts culm length “random change” to 20%, resulting in a grove of culms whose lengths vary by +/- 20% of the length set by the culm “Length” parameter. Similarly, it sets culm angle “random change” to 2 degrees, resulting in culms whose angles vary by +/- 2deg of the angle set by the culm “Angle” parameter. Following are the parameters affected by “Randomize bamboo”:

- Culm Length random change
- Culm Node Branching random change
- Culm Internode Length initial i-node random change (factor 0.5)
- Culm Internode Length successive i-nodes random change (factor 0.5)
- Culm Angle random change (factor 0.1)
- Culm Twist random change (factor 3.6)
- Culm Curving Random regions
- Culm Curving Random angles
- Culm Color random change
- Branch1 Length random change (factor 0.5)
- Branch1 Node Branching random change



Branch1 Internode Length random change (factor 0.5)
Branch1 Cluster leader dominance random change
Branch1 Cluster angle spread random change
Branch1 Cluster twist spread random change
Branch1 Multi-Bud spread random change (factor 0.2)
Branch1 Multi-Bud density random change
Branch1 Angle random change (factor 0.5)
Branch1 Twist Random Change for first branch
Branch1 Twist Random Change for successive branches
Branch1 Curving Random regions
Branch1 Curving Random angles
Branch1 Color random change

Branch2+ Length random change (factor 0.5)
Branch2+ Node Branching random change,
Branch2+ Internode Length random change (factor 0.5)
Branch2+ Cluster leader dominance random change
Branch2+ Cluster angle spread random change
Branch2+ Cluster twist spread random change
Branch2+ Multi-Bud spread random change (factor 0.2)
Branch2+ Multi-Bud density random change
Branch2+ Angle random change (factor 0.1)
Branch2+ Twist Random Change for first branch
Branch2+ Twist Random Change for successive branches
Branch2+ Curving Random regions
Branch2+ Curving Random angles
Branch2+ Color random change

Leaf Number random change (factor 0.1)
Leaf Length random change for initial leaf
Leaf Length random change for successive leaves
Interleaf Length random change
Interleaf Length sheath length random change
Leaf Angle random change (factor 0.2)
Leaf Angle roll mirror random change



Leaf Twist random change (factor 0.9)
Leaf Twist Random Roll for single leaves (factor 0.9)
Leaf Twist Random Roll for leaf groups (factor 0.9)
Leaf Curving Random regions
Leaf Curving Random angles
Leaf Curving Random extreg1
Leaf Color random change

Randomize **grove** is a global parameter that simultaneously sets the values to all grove random parameters [0...100%]. When set to 40%, for example, it sets rhizome internode length “random change” to 40%, resulting in rhizomes whose lengths vary by +/- 40% of the length set by the “rhizome inode length” parameter. Similarly, It sets rhizome internode angle “random change” to 4deg, resulting in rhizomes whose angles vary by +/- 4deg of the angle set by the “rhizome inode angle” parameter. Following are the parameters affected by “Randomize grove”:

Grove Habit rhizome inode length random change
Grove Habit rhizome inode angle random change (factor 0.1)

Randomize **growth** is a global parameter that simultaneously sets the values to all growth random parameters [0...100%]. When set to 30%, for example, it sets culm growth “random change” to 30%, resulting in culms whose growth speeds vary by +/- 30% of the speed set by the culm growth “speed” parameter. Following are the parameters affected by “Randomize grove”:

Grove Growth random change
Culm Growth random change
Branch1 Growth random change
Branch1 Growth positioning random change
Branch2+ Growth random change
Branch2+ Growth positioning random change

Leaf Growth random change

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Length parameter sets the length of bamboo grove - i.e. the area within which a bamboo grows [10cm ... 500cm]. This parameter is also accessible from within Grove Form window.

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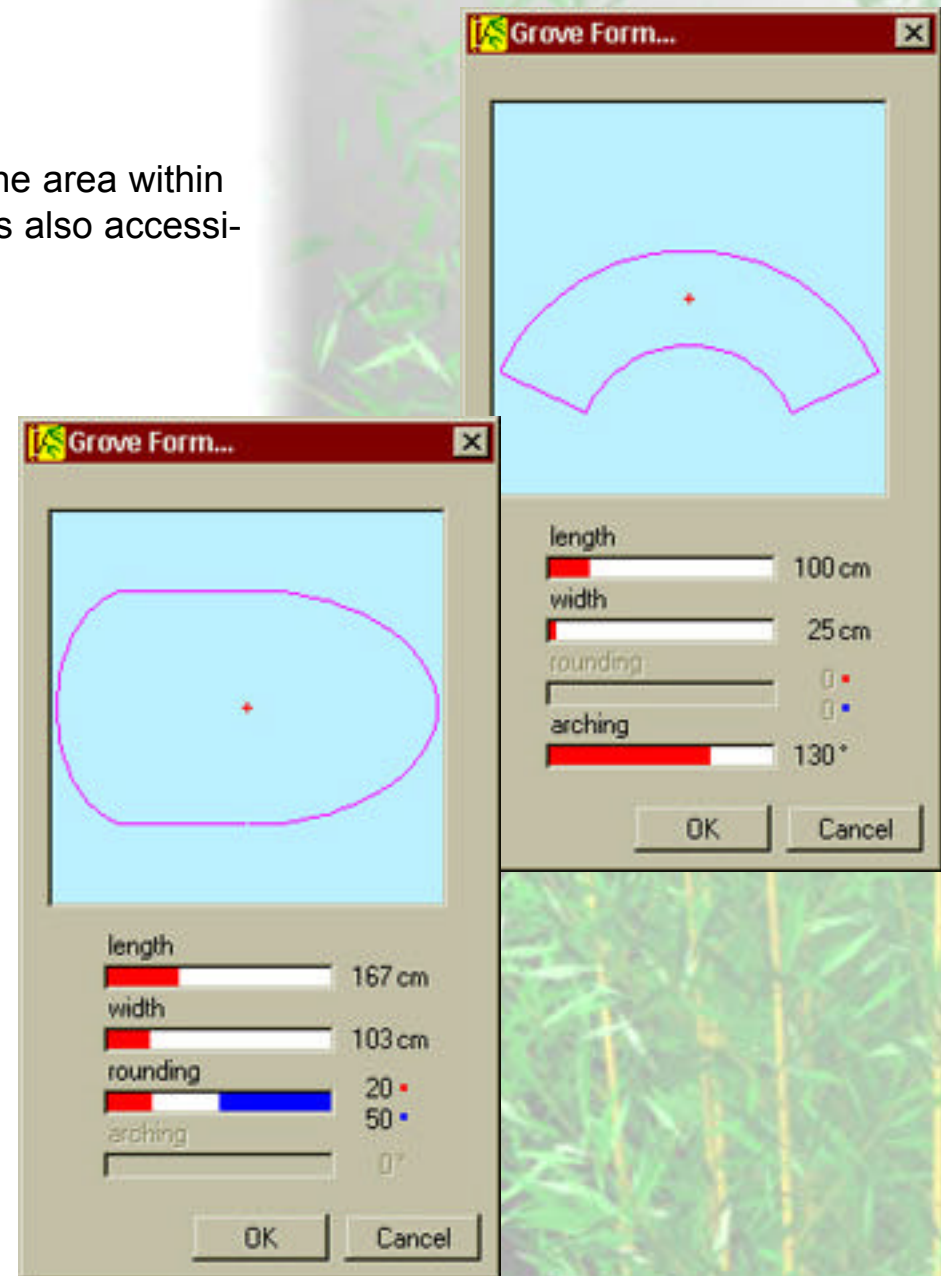
Width parameter sets the width of bamboo grove [10cm ... 500cm]. This parameter is also accessible from within Grove Form window.

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Pressing grove **Form** button displays Grove Form window. The upper portion shows a qualitative top-view of the grove drawn in violet color. There is also a small red cross located somewhere within the grove area. It defines a position of the initial or reference bamboo culm in this grove. The initial bamboo culm can be positioned anywhere within the grove area by pointing at the position with the mouse and pressing the mouse button. Once the mouse button has been released, the small red cross appears at the pointed location indicating the new location of the initial bamboo culm.

Length parameter sets the length of grove [10... 500cm].

Width parameter sets the width of grove [10... 500cm].



Rounding parameter has two sliders [0...100, R/B]. The red one adjusts the roundness of left edge of the grove. The blue one adjusts the roundness of right edge of the grove. "Rounding" is disabled if "arching" is set.

Arching parameter sets the arching of the grove's top and bottom edges [0...VARdeg]. "Arching" is disabled if "rounding" is set.

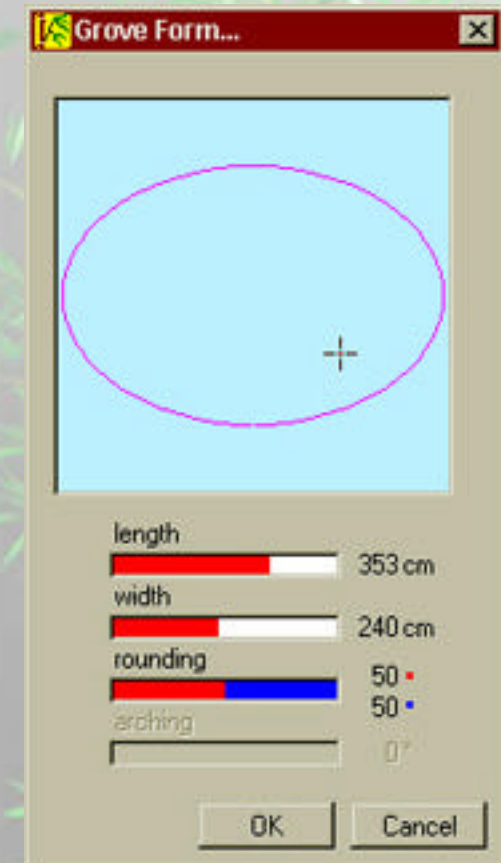
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Grove **Habit** parameter window contains parameters related to the bamboo rhizome behavior. You can also set the number of culms in a grove.

Min. (minimum) culm spacing parameter sets the culm cell size [1...100cm]. The culm cell defines an area within which a single culm can grow. The culm cell size affects the density of a grove. These cells are drawn as grid lines in blue color. They are visible only if "show grove grid" is checked and if Grove display button is pressed.

Rhizome inode (internode) length parameter defines the distance between the culm producing nodes of a rhizome [1...100cm]. It affects the density of a grove. The rhizome internodes are drawn in red color. They are visible only if "show rhizome branching" is checked and if Grove display button is pressed.

Rhizome inode length **random change** parameter sets the extent of variations of distances between the culm producing nodes of a rhizome [0...100%] UL/L. Please note that this parameter has a Lock button on the side. Since the value of this parameter can also be changed globally by the "Randomize bamboo" parameter, the Lock assures that the global control has no influence.

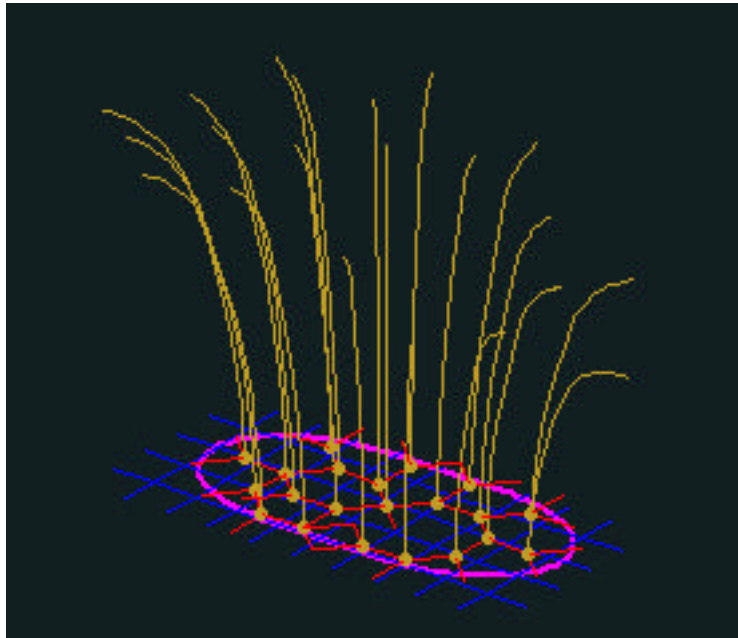


Rhizome inode (internode) angle parameter defines the half-angle between two rhizome branches. [10...80deg].

Rhizome inode angle **random change** parameter defines the variations of angles between rhizome branches [0...10deg] UL/L. It has a Lock button.

Rhizome starts at parameter sets the angle between x axis and first rhizome branch [0...45deg]. One may also say that this parameter specifies the initial orientation of quadruple rhizome branches.

Grove Fill parameter has two check boxes **P** (partial) and **F** (full). When “P” is checked, the grove will be inhabited with culms whose number is set by the associated slider to the right of the check box. The number of culms can range from 1 to 100. When “F” is checked, the grove will be inhabited fully, i.e. all culm cells are inhabited as long as the total number of culms does not exceed 1000.



Show grove grid, when checked, displays culm cells that are drawn as grove grid lines in blue color. To see them, Grove display button must be pressed too. The culms are shown schematically as lines with dots at the

Parameter	Value	Lock
min. culm spacing	10 cm	
rhizome inode length	10 cm	
rhizome inode angle	45°	
rhizome starts at	0°	
Grove Fill (P)	31 culms	
show grove grid	checked	
show rhizome branch	checked	

base.

Show rhizome branching, when checked, displays rhizome branching pattern that is drawn in red color. To see them, Grove display button must be pressed too. The culms are shown schematically as lines with dots at the base.

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Grove **Growth** parameter window contains parameters related to rhizome growth.

Random change parameter sets the extent of variations in growth speed among different rhizome generations [0...100%] [UL/L]. It has a Lock button.

Speed parameter sets the rhizome growth speed . [1...100, Gn/Y (generation/year) - Gn/M (generation/month)]. The pull down menu to the right of the “speed” slider sets the units. The units are in Gn/Y, i.e. generation per year, and Gn/M, i.e. generation per month. One generation includes all the children of a parent rhizome branch.





Culm Parameters

BAMBOO culm is a part of bamboo that grows from underground rhizome. It is segmented by nodes and carries culm branches of the first generation.

BAMBOO culm parameters are activated by pressing the Culm button - the second out of five buttons in the Group levels section. That brings up the following top level and subsequent level culm parameters:

Random Seed “

Randomize...

Bamboo

Grove

Growth

Length “

Random change, UL/L

Progression in Grove

L/R/F/B/C

To min. length

Change factor

Width

Node

Model node

Break node

Upper extension

Middle extension

Lower extension

Upper width

Middle width

Lower width

Branching

Zone, R/B

Group level buttons

Bambusa multiplex grove

1	Random Seed "
312 cm	Length "
26 mm	Width
	Node
230 mm	INode Length "
0 °	Angle "
47 °	Twist
	Curving
	Color
	Growth

Group level buttons

Bottom row of buttons: [Grid] [Culm (highlighted)] [Branching] [Node] [Leaf]

Random change, UL/L
Progression in grove
L/R/F/B/C
To min. height
Change factor

INode (internode) Length “

Random change for...
Initial I-node (internode), UL/L
Successive I-nodes (internodes), UL/L
Top reduction
To min. length
Starts at
Bottom reduction
To min. length
Ends at

Angle “

Random change, UL/L
Node zig-zag
Progression in grove
L/R/F/B/C
To min. angle
Change factor

Twist

Random change, UL/L
Progression in grove
L/R/F/B/C

Curving

Hs (heights), 3
Angles
Region T
Region M
Region B

Random...
Regions, UL/L



- Angles, UL/L
- Link to culm length
- Horizontal curving
- Curving resolution
- Transversal resolution
- P(progression in)-Grove
 - Progression in grove
 - L/R/F/B/C
 - Hs (heights), 3
 - Angles
 - Region T
 - Region M
 - Region B
 - Change factor
 - Margin width
- E(exceptions in)-Grove
 - Hs (heights), 3
 - Angles
 - Region T
 - Region M
 - Region B
 - # of exceptions

Color

- Random change, UL/L
- Internode palette, S/E
- Node palette, S/E
- Long. contrast
 - Starts at
- Trans. contrast
 - Starts at

Growth

- Random change, UL/L
- Speed
- Node activation



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Random Seed parameter enables you to create different instances of the same bamboo by changing its value [1...1000]. On double click, it brings up Random Seed window with three parameters that randomize the bamboo, the bamboo grove, and the bamboo growth. This window is accessible on all five Group levels, i.e. Grove, Culm, Branch1, Branch2+, and Foliage level. Detailed description of these global parameters is located on page 29.

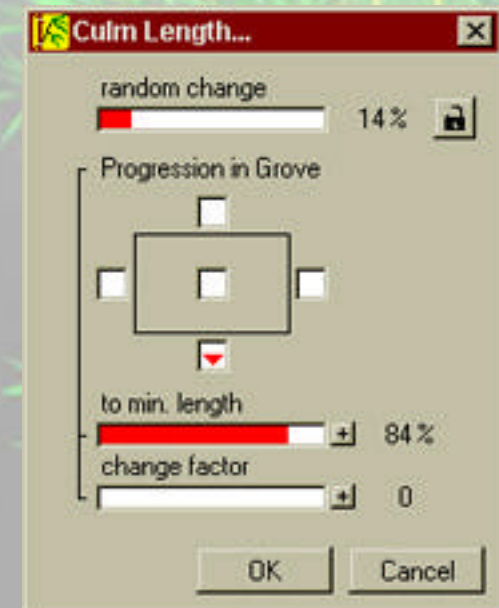
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Culm **Length** sets the length of bamboo culm [1...2000cm]. When double clicked it brings up Culm Length window with parameters related to culm length of a single bamboo as well as the lengths of bamboo culms in a grove.

Random change parameter defines the extent of variations of culm lengths in a grove as well as in different instances of single culm bamboos [0...100%] [UL/L]. It has a Lock button.

Progression in Grove parameter has five check boxes. L(left), R(right), N(near), F(far), and C(center). If the center is checked, then the lengths of other culms in a grove will gradually change from the initial (reference) culm towards the perimeter of the grove.

Progression in Grove **to min. (minimum) length** parameter sets the minimum culm length in a grove [0...100%][+/-]. The +/- box defines whether the minimum length will be assigned to the reference culm or to the culms on the perimeter of the grove.



Progression in Grove **change factor** parameter defines the change of culm lengths [0...100][+/-]. If it is set to zero then the change is linear. If it is set to + value then the change is concave, for - value the change is convex. The value of the parameter designates a degree of deviation from the linear change.

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Width parameter sets the width of bamboo culm [1... 250mm].

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Pressing the culm **Node** button opens the window with culm node parameters.

Model node, when checked, commands BAMBOO to model culm nodes [UC/C]. Model node should be checked for closeup renderings. A node is comprised of three cylindrical (or conical) sections - upper, middle, and lower section or part. Each cylinder has its length or extension and its width.

Break node, when checked, commands BAMBOO to segment (break) the culm at nodes [C/UC]. Only when the culm is segmented at nodes, the nodes can be modeled, i.e. when “break node” is not checked, “model node” is unchecked and dimmed.

Upper extension parameter sets the length of an upper part of modeled node [1...100mm].

Middle extension parameter sets the length of a middle part of modeled node [1...100mm].

Culm Node...

☒ model node ☒ break node

upper extension 5 mm

middle extension 5 mm

lower extension 15 mm

upper width 5.0 mm

middle width 5.0 mm

lower width 5.0 mm

Branching...

zone 45

random change 100

30%

Progression in Grove

to min. height 0%

change factor 0

OK Cancel

Lower extension parameter sets the length of a lower part of modeled node [1...100mm].

Upper width parameter sets the width of an upper part of modeled node [0.1...90mm].

Middle width parameter sets the width of a middle part of modeled node [0.1...90mm].

Lower width parameter sets the width of a lower part of modeled node [0.1...90mm].

Branching **zone** parameter has two sliders: red and blue. The red slider sets the culm height below which the nodes do not grow branches, i.e. the bottom non-branching zone. The blue slider sets the culm height above which there are no branches, i.e. the top non-branching zone. The nodes are there but there are no branches. Branches grow only between the values of red and blue slider [0...100, R/B].

Branching **random change** parameter randomizes the values set by the branching zone parameters [0...100%] [UL/L]. It has a Lock button.

Branching **Progression in Grove** parameter has five check boxes. L(left), R(right), N(near), F(far), and C(center). If the center is checked, then the bottom non-branching zone of other culms in a grove will gradually change from the initial (reference) culm towards the perimeter of the grove.

Progression in Grove **to min. (minimum) height** parameter sets the minimum bottom non-branching zone for culms in a grove [0...100%][+/-].

The +/- box defines whether the minimum non-branching zone will be assigned to the reference culm or to the culms on the perimeter of the grove.

Progression in Grove **change factor** parameter defines the change of bottom non-branching zone [0...100][+/-]. If it is set to zero then the change is linear. If it is set to + value then the change is concave, for - value the change is convex. The value of the parameter designates a degree of deviation from the linear change.

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INode (internode) Length parameter sets the distance between adjacent culm nodes [10...1000mm]. On double click, it brings up Culm Internode Length window with additional internode parameters.

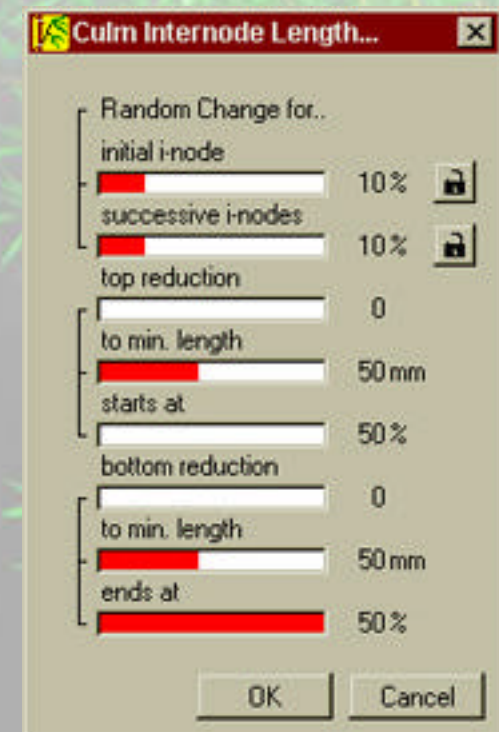
Random Change for **initial i(inter)-node** parameter defines the extent of variations of the initial internode lengths on multiple culms [0...50%] [UL/L]. It has a Lock button.

Random Change for **successive i(inter)-nodes** parameter defines the extent of length variations of successive internodes on a single and multiple culms [0...50%] [UL/L]. It has a Lock button.

Top reduction parameter reduces the internode lengths toward the top of the culm [0...100]. For 0 value there is no reduction.

Top reduction **to min. (minimum) length** parameter defines the minimum internode length to be reduced with the “top reduction” parameter [10...100mm]. The internode cannot be shorter than the one set here.

Top reduction **starts at** parameter sets the height of the culm above



which the internodes get gradually reduced in length [50...100%].

Bottom reduction parameter reduces the internode length toward the bottom of the culm [0...100]. For 0 value there is no reduction.

Bottom reduction **to min. (minimum) length** parameter defines the minimum internode length to be reduced with the “bottom reduction” parameter [10...100mm]. The internode cannot be shorter than the one set here.

Bottom reduction **ends at** parameter sets the height of the culm below which the internodes get gradually reduced in length [0...50%].

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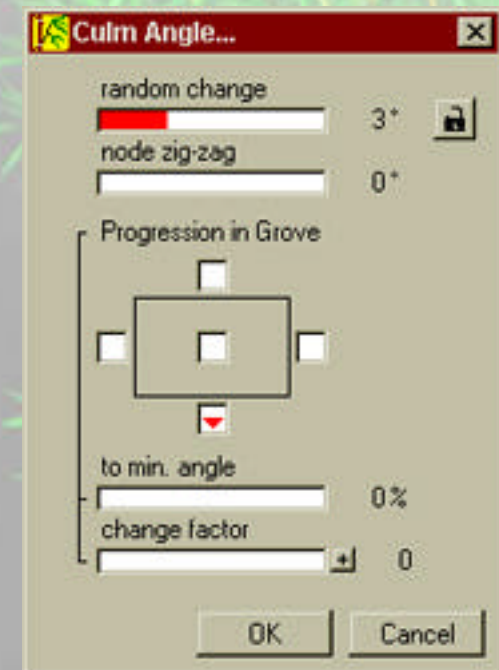
Culm **Angle** parameter sets the angle of culm with reference to the vertical axis. [0...90deg]. On double click it brings up Culm Angle window with additional culm angle parameters.

Random change parameter defines the extent of variations in culm angles [0...10deg] [UL/L]. It has a Lock button.

Node zig-zag parameter defines the zig-zag angle of internode sections [0...10deg]. Zig-zagging of the culm occurs sometimes because of the tensions in the nodes caused by branch growth.

Progression in Grove parameter has five check boxes. **L** (left), **R** (right), **N** (near), **F** (far), and **C** (center). If the N and R are checked, then all the bamboos in a grove will be angled toward the front-right perimeter of the grove.

Progression in Grove **to min. (minimum) angle** parameter sets the mini-



mum culm angle in a grove [0...100%]. If it is set to +100% and the N and R in Progression in Grove are checked, then the front-right perimeter culms will be angled nominally, i.e. as set by the culm “Angle” parameter, while far-left perimeter culms will be vertical. The bamboo culms in between will have angles in between the nominal and zero value. The zero percent setting has all the culms in the grove at an angle set by the culm “Angle” parameter.

Progression in Grove **change factor** parameter defines the change of culm angles across the grove [0...100][+/-]. If it is set to zero then the change is linear. If it is set to + value then the change is concave, for - value the change is convex. The value of the parameter designates a degree of deviation from the linear change.

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Culm **Twist** parameter sets the twist of culm with reference to the horizontal x-axis. [0...360deg]. On double click it brings up Culm Twist window with additional culm twist parameters.

Random change parameter defines the extent of variations in culm twists [0...360deg] [UL/L]. It has a Lock button.

Progression in Grove parameter has five check boxes. **L** (left), **R** (right), **N** (near), **F** (far), and **C** (center). They define the change of culm twists across the grove. To observe the behavior of this parameter, make a square grove of bamboos showing only culms and branches B1. Look at the grove from 90 degrees elevation (top view). Press different check boxes and observe the behavior. Note that these settings annulate the culm twist value as set by the culm “Twist” parameter.



Culm **Curving** button brings up Culm Curving window with the parameters related to curvatures of the reference culm and other culms in the grove.

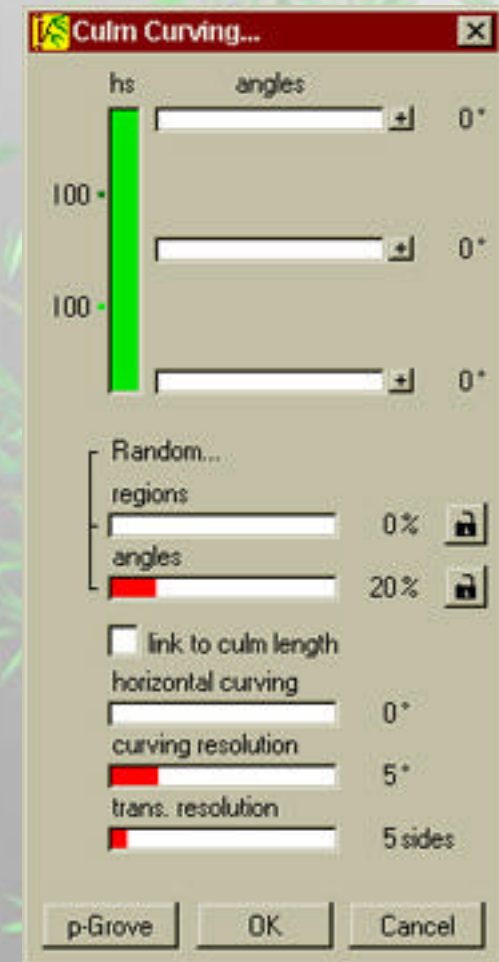
Heights - hs - parameter is a vertical bar with two sliders [0...100] [0...100]. Their values are shown on the left side of the bar. A value of one hundred corresponds to the full culm length. Those two sliders set three curving regions of the culm which can be curved independently. The three regions are designated with three different colors: light green, dark green, and crimson.

Angles parameters are actually three horizontal sliders [LG/DG/CR] [0...180deg] [+/-]. These sliders are designated with three different colors (light green, dark green, and crimson) and they control the curvatures of the corresponding curving regions. Example: if both hs sliders are set to 100, then there is only one region - LG - light green. Upper two horizontal sliders have no effect on this region. The bottom slider is the one that controls the curvature of the given region. +/- buttons to the right of these sliders set the direction of curving for the corresponding curving regions.

Random **regions** parameter varies "hs" curving regions [0...100%] [UL/L]. It has a Lock button.

Random **angles** parameter varies curving set by the horizontal "angles" sliders [0...100%] [UL/L]. It has a Lock button.

Link to culm length parameter check box, when checked, links the curving regions to the culm length of the current bamboo which may vary from the culm length as set by the culm "Length" parameter. This means



that all the culms in a grove, be they short or long, will curve in similar fashion. If unchecked, the curving regions will be mapped to the culm length as set by the culm “Length” parameter. As a result, the shorter culms in a grove will curve proportionally less than the longer ones.

Horizontal curving parameter bends the trunk around the vertical axis [0...20deg].

Curving resolution parameter sets the minimum bending angle at which additional culm segmentation must occur to preserve the specified curving resolution [1...20deg]. The higher the value, the less segments will be needed resulting in the smaller number of polygons.

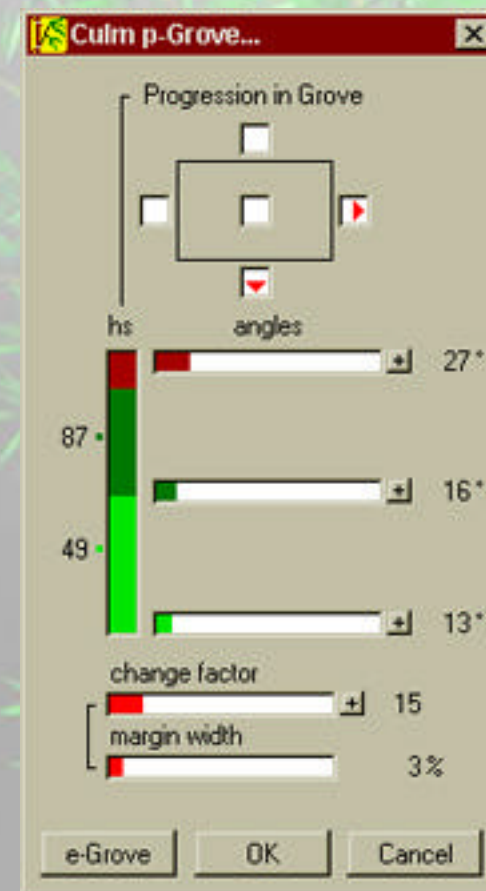
Trans. (transversal) resolution parameter sets the number of polygons around the circumference of the culm [3...32sides].

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Pressing **p(progression in)-Grove** button in Culm Curving window brings the p(progression in)-Grove parameter window with additional curving parameters that control curving changes for the culms as a function of their positions in a grove. The curving set with these parameters apply to the culms at the perimeter of the grove. The curving changes occur gradually from the reference culm to the perimeter of the grove.

Progression in Grove parameter has five check boxes. L(ef), R(ight), N(ear), F(ar), and C(enter). They define the direction of curving changes for the culms in a grove.

Heights - hs - parameter is a vertical bar with two sliders [0...100] [0...100]. Their values are shown on the left side of the bar. A value of



one hundred corresponds to the full culm length. Those two sliders set three curving regions of the culm which can be curved independently. The three regions are designated with three different colors: light green, dark green, and crimson.

Angles parameters are actually three horizontal sliders [LG/DG/CR] [0...180deg] [+/-]. These sliders are designated with three different colors (light green, dark green, and crimson) and they control the curvatures of the corresponding curving regions. Example: if both hs sliders are set to 100, then there is only one region - LG - light green. Upper two horizontal sliders have no effect on this region. The bottom slider is the one that controls the curvature of the given region. +/- buttons to the right of these sliders set the direction of curving for the corresponding curving regions.

Change factor parameter defines curving change for the culms across the grove [0...100][+/-]. If it is set to zero then the change is linear. If it is set to + value then the change is concave, for - value the change is convex. The value of the parameter designates a degree of deviation from the linear change.

Change factor **Margin width** parameter sets the distance from the grove perimeter at which the curvature changes stop occurring [0...50%]. If it is zero then the culms at a perimeter of a grove will assume the curving set by p-Grove curving parameters. If it is fifty then the culms half way from the perimeter will assume the curving set by p-Grove curving parameters and the culms that are closer to the grove perimeter will have the same curvatures as the ones half way from the perimeter.

Culm **e(exceptions in)-Grove** parameter window comes up when you press e-Grove button in Culm p-Grove window. These parameters set the number of excepted culms. i.e. the culms that do not curve the same way as the rest of the culms in a grove, and their curvatures. These culms grow closest to the borders of a grove.

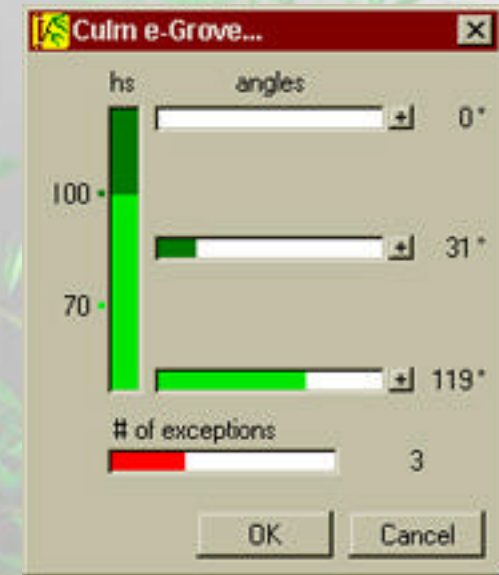
Heights - hs - parameter is a vertical bar with two sliders [0...100] [0...100]. Their values are shown on the left side of the bar. A value of one hundred corresponds to the full culm length. Those two sliders set three curving regions of the culm which can be curved independently. The three regions are designated with three different colors: light green, dark green, and crimson.

Angles parameters are actually three horizontal sliders [LG/DG/CR] [0...180deg] [+/-]. These sliders are designated with three different colors (light green, dark green, and crimson) and they control the curvatures of the corresponding curving regions. Example: if both hs sliders are set to 100, then there is only one region - LG - light green. Upper two horizontal sliders have no effect on this region. The bottom slider is the one that controls the curvature of the given region. +/- buttons to the right of these sliders set the direction of curving for the corresponding curving regions.

of exceptions parameter defines how many culms in this grove will have different curvatures [0...10].

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Culm **Color** parameter button brings up Culm Color window. Here you can set the color of culm internodes and culm nodes as well as its contrasts.



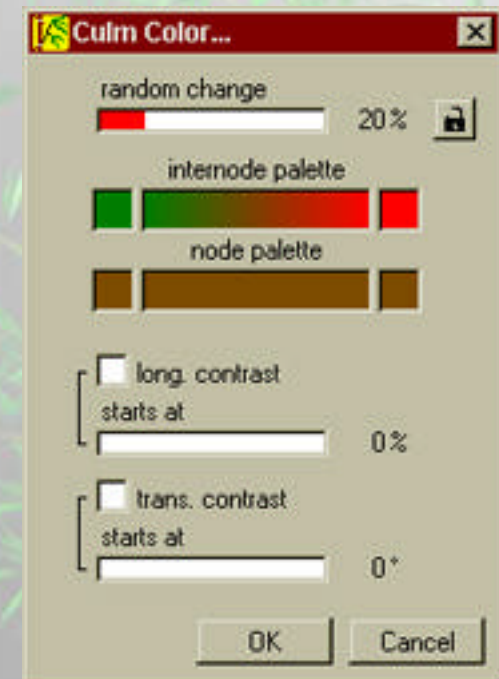
Random change parameter randomizes the RGB values of colors between starting (displayed in the left box) and ending color (displayed in the right box) [0...100%] [UL/L]. It has a Lock button.

Internode palette shows the colors on the culm internodes if any of the two contrast are checked. Two boxes to the left and to the right of the palette show starting and ending colors and are mouse activated. When any of the two is selected, it brings up standard Windows color picker, where you can select a desired color. The palette will display the colors in between the two colors shown in the left and right boxes. If longitudinal and transversal contrasts are not active, the culm internodes assume the starting color (shown in the left box), otherwise they assume the range of colors shown in the palette.

Node palette shows the colors on the culm nodes if any of the two contrast are checked. Two boxes to the left and to the right of the palette show starting and ending colors and are mouse activated. When any of the two is selected, it brings up standard Windows color picker, where you can select a desired color. The palette will display the colors in between the two colors shown in the left and right boxes. Culm nodes assume the range of colors shown in the palette.

Long. (longitudinal) contrast checkbox enables longitudinal contrast [UC/C]. Longitudinal contrast applies the internode palette colors from the bottom to the top of the culm and it applies the node palette colors from the top and bottom edges of each node to its center. Longitudinal contrast for the nodes is always applied.

Long. contrast **starts at** parameter defines the height of the culm at which the color starts to change [0...100%]. If it is fifty, for example, then



the bottom half of the culm will have the starting color (shown in the box to the left of the color palette) and the colors of the top half of the culm will gradually change from the starting color to the ending color (shown in the box to the right of the color palette).

Trans. (transversal) contrast checkbox enables transversal contrast function [UC/C]. Transversal contrast applies the internode palette colors around the circumference of culm internodes and it applies the node colors around the circumference of each culm node.

Trans. contrast **starts at** parameter defines the angle along the culm circumference at which the culm color starts to change if transversal contrast is active [0...360deg].

- 000 -

Culm **Growth** parameter window contains parameters related to culm growth.

Random change parameter sets the extent of variations in the speed of culm growth [0...100%] [UL/L]. It has a Lock button.

Speed parameter sets the speed of culm growth[1...100] [cm/M (Month), cm/d (day)].

Node activation sets the rate at which successive nodes appear on the culm during its growth [0...100%]. If it is zero then all the nodes appear at the same time. If greater than zero then the successive nodes will follow each other with delay.

Node activation **successive delays** parameter defines the dormancy time of the successor node [0...100days].





Branch1 Parameters

BAMBOO branch1 parameters are activated by pressing the Branch1 button in the Group levels section. That brings up the following top level and subsequent level parameters:

Random Seed “

Randomize...

Bamboo

Grove

Growth

Length “

Random change, UL/L

Hs (heights)

Top region change

Top region linear f.(function)

Max.(maximum) length

Bottom region change

Bottom region linear f.(function)

Link to culm length

To minimum

Width

Node

Model node

Break node

Upper extension

Middle extension

Lower extension

Upper width

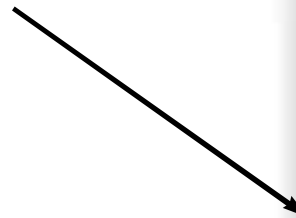
Middle width

Lower width

Branching...

Zone, R/B

Group level buttons



The screenshot shows the 'BAMBOO' software interface. At the top, the title bar reads 'BAMBOO multiplex grove'. Below this, there is a main panel with several buttons and input fields. The buttons are arranged in a grid-like fashion. The first row has a button labeled '1' and a button labeled 'Random Seed "'. The second row has a button labeled '100 cm' and a button labeled 'Length "'. The third row has a button labeled '10mm' and a button labeled 'Width'. The fourth row has a button labeled '78mm' and a button labeled 'Node'. The fifth row has a button labeled '45 °' and a button labeled 'INode Length "'. The sixth row has a button labeled '0 °' and a button labeled 'Cluster'. The seventh row has a button labeled 'Angle "'. The eighth row has a button labeled 'Twist "'. The ninth row has a button labeled 'Curving'. The tenth row has a button labeled 'Color'. The eleventh row has a button labeled 'Growth'. To the right of these buttons is a vertical slider bar with a red indicator. At the bottom of the interface is a toolbar with five icons: a grid, a vertical line, a branch (highlighted in yellow), a leaf, and a leaf.

- Random change, UL/L
- Inode (internode) Length “
 - Random change, UL/L
 - Top reduction
 - To min.(minimum) length
 - Starts at
 - Link to branch length
 - To minimum
- Cluster
 - Sky sensitive
 - Leader dominance, R/B
 - Random change, UL/L
 - Cluster angle spread
 - Random change, UL/L
 - Cluster twist spread
 - Random change, UL/L
 - Hs (heights)
 - Region M
 - Cluster progression
 - Region T
 - Region M
 - Region B
- Multi-Bud
 - Spread
 - Random change, UL/L
 - Density
 - Random change, UL/L
- Angle “
 - Random change, UL/L
 - Linear change
 - Starts at
 - Node zig-zag
- Twist “
 - Random Change for...



- First branch, UL/L
- Successive branches, UL/L
- Progression
- Curving
 - Hs(heights)
 - T-M border
 - M-B border
 - Angles/change
 - Region T
 - Region M
 - Region B
 - Random...
 - Regions, UL/L
 - Angles, UL/L
 - Link to branch length, UC/C
 - Horizontal curving
 - Curving resolution
 - Trans.(transversal) resolution
 - P(progression in)-Grove
 - Progression in grove
 - L/R/F/B/C
 - Hs(heights)
 - T-M border
 - M-B border
 - Angles
 - Region T
 - Region M
 - Region B
 - Change factor
- Color
 - Random change, UL/L
 - Internode palette, S/E
 - Node palette, S/E
 - Long.(longitudinal) contrast, UC/C



- Starts at
- Trans.(transversal) contrast, UC/C
- Starts at
- Growth
 - Random change, UL/L
 - Speed
 - Node activation
 - Successive delays
 - Positioning
 - Shorten/prolong, +/-
 - Random change, UL/L
 - Cluster growth starts...
 - As the culm elongates, UC/C
 - After the culm's elongation, C/UC
 - Starts at
 - Initial delay
 - Successive delays

- 000 -

Random Seed parameter enables you to create different instances of the same bamboo by changing its value [1...1000]. On double click, it brings up Random Seed window with three parameters that randomize the bamboo, the bamboo grove, and the bamboo growth. This window is accessible on all five Group levels, i.e. Grove, Culm, Branch1, Branch2+, and Foliage level. Detailed description of these global parameters is located on page 29.

- 000 -

Branch1 **Length** parameter sets the maximum length of the first generation branches [0...500cm]. The first generation branches are those that grow from the culm. When double clicked it brings up Branch1 Length



window with parameters related to branch1 lengths.

Random change parameter sets the extent of length variations of the first generation branches on a single culm as well as on the multiple culms in a grove [0...50%] [UL/L]. It has a Lock button.

Heights - hs - parameter is a vertical bar with one dark green slider [0...100]. Its value is located on the left side of the bar (designated by a dark green dot). A value of one hundred corresponds to the full culm length. This slider sets the culm height at which the longest branch springs out.

Change/linear f. (function) parameters are actually two pairs of sliders located to the right of the top and the bottom of the vertical “hs” bar.

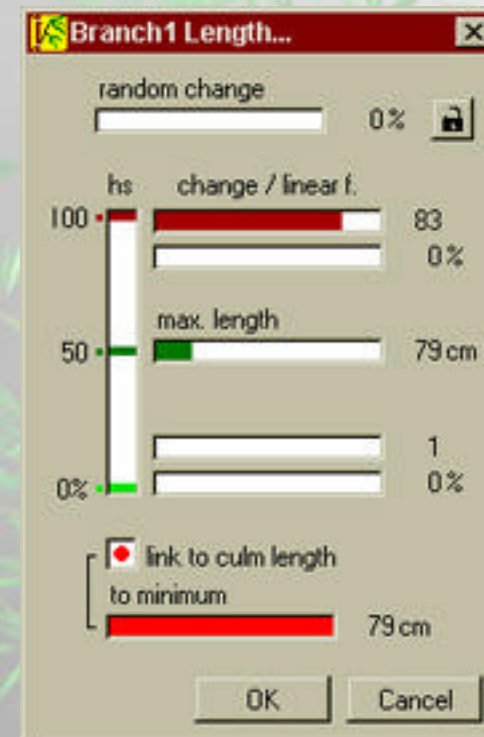
The top **change** slider (in crimson color) modulates the lengths of branches towards the top of the culm [1..100].

The bottom **change** slider (in light green color) modulates the lengths of branches towards the bottom of the culm [1..100].

The top **linear f.** slider (in crimson color) adds linearity to the change set by the top “change” slider. This has an effect of extending the lengths of branches towards the top of the culm [0...100%].

The bottom **linear f.** slider (in light green color) adds linearity to the change set by the bottom “change” slider. This has an effect of extending the lengths of branches towards the bottom of the culm [0...100%].

Max. (maximum) length parameter (the dark green slider between the top and bottom “change/linear f.” slider pairs) sets the maximum length



of the first generation branches [0...500cm].

Link to culm length parameter check box, when checked, links the maximum branch length to the culm length as set by the culm “Length” parameter. This means that other culms in a grove that have smaller height will produce branches that are proportionally shorter [UC/C].

Link to culm length **to minimum** parameter sets the minimum branch length allowed if “link to culm length” is checked [0...VARmm].

- 000 -

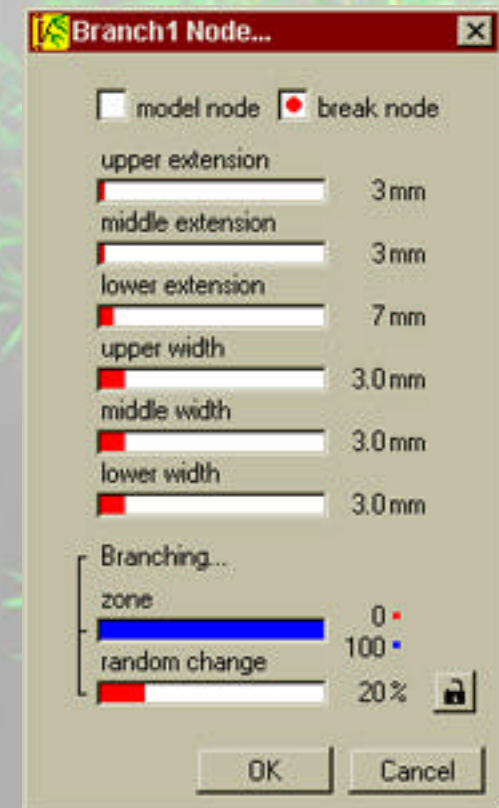
Width parameter sets the width of the longest first generation branch [1... 100mm]. Note that the first generation branch cannot be thicker than the culm from which it grows.

- 000 -

Pressing the branch1 **Node** button opens the window with branch1 node parameters.

Model node, when checked, commands BAMBOO to model branch1 nodes [UC/C]. Model node should be checked for closeup renderings. A node is comprised of three cylindrical (or conical) sections - upper, middle, and lower section or part. Each cylinder has its length or extension and its width.

Break node, when checked, commands BAMBOO to segment (break) the branch1 at nodes [C/UC]. Only when the branch1 is segmented at nodes, the nodes can be modeled, i.e. when “break node” is not checked, “model node” is unchecked and dimmed.



Upper extension parameter sets the length of an upper part of modeled node [1...100mm].

Middle extension parameter sets the length of a middle part of modeled node [1...100mm].

Lower extension parameter sets the length of a lower part of modeled node [1...100mm].

Upper width parameter sets the width of an upper part of modeled node [0...90mm].

Middle width parameter sets the width of a middle part of modeled node [0...90mm].

Lower width parameter sets the width of a lower part of modeled node [0...90mm].

Branching **zone** parameter has two sliders: red and blue. The red slider sets the branch1 height below which the nodes do not grow child branches, i.e. the bottom non-branching zone. The blue slider sets the branch1 height above which there are no child branches, i.e. the top non-branching zone. The nodes are there but there are no branches. Branches grow only between the values of red and blue slider [0...100, R/B].

Branching **random change** parameter randomizes the values set by the branching zone parameters [0...100%][UL/L]. It has a Lock button.

- 000 -

INode (internode) Length parameter sets the distance between adjacent branch1 nodes [10...500mm]. On double click it brings up Branch1



Internode Length window with additional internode parameters.

Random change parameter sets the extent of variations of the internode lengths [0...50%] [UL/L]. It has a Lock button.

Top reduction parameter reduces the internode lengths toward the top of the first generation branches [0...100]. For 0 value there is no reduction.

Top reduction **to min. (minimum) length** parameter sets the minimum internode length to be reduced with the “top reduction” parameter [10...100mm]. The internode cannot be shorter than the one set here.

Top reduction **starts at** parameter sets the height of the first generation branches above which the internodes get gradually reduced in length [50...100%].

Link to branch length parameter check box, when checked, links the maximum internode length to the branch length as set by the branch1 “Length” parameter. This means that other branches of the first generation that have smaller lengths will have internodes that are proportionally shorter [UC/C].

Link to branch length **to minimum** parameter sets the minimum internode length allowed if “link to branch length” is checked [1...VARmm].

- 000 -

Branch1 **Cluster** button brings up Branch1 Cluster window with branch1 cluster parameters. Cluster is a bunch of first generation branches growing from the same culm node.



Sky sensitive parameter forces the downward growing branches of the first generation to grow upward towards the sky [0...100%].

Leader dominance is a double slider [100...0] [100...0]. If there are two or more branches in a cluster then the red slider adjusts the length of the two second tier inferior branches, and the blue slider adjusts the length of the two first tier inferior branches with respect to the dominant branch on this culm node. If the blue value is set to 100 then the first tier branches have the same length as the dominant branch. If the blue value is set to zero then the two first tier inferior branches have zero length. If the red value is set to 100 then the second tier branches have the same length as the dominant branch. If the red value is set to zero then the two second tier inferior branches have zero length. The second tier branches in the cluster cannot exceed the length of the first tier branches.

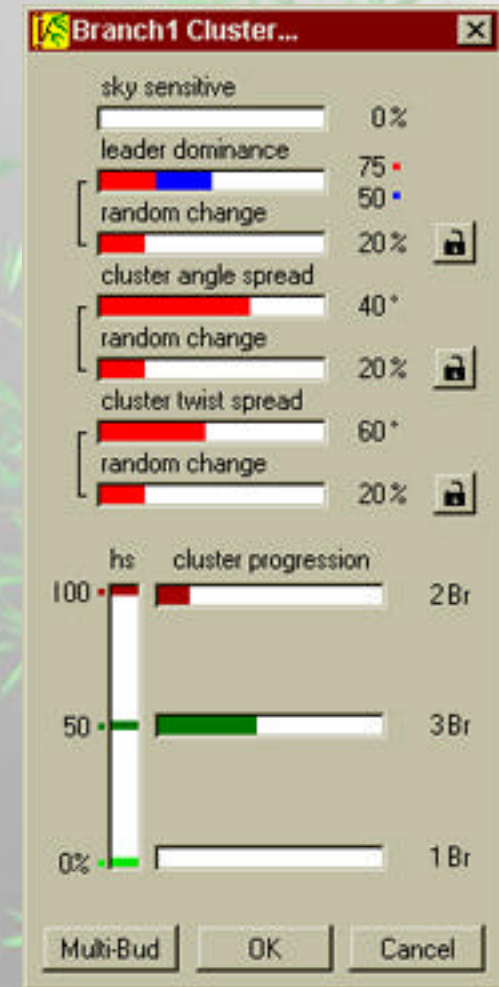
Leader dominance **random change** parameter sets the extent of variations in the lengths of inferior branches in the cluster [0...100%] [UL/L]. It has a Lock button.

Angle spread parameter sets the maximum angle among the branches in a cluster [20...50deg].

Angle spread **random change** parameter sets the extent of variations in the angle spread of branches in the cluster [0...100%] [UL/L]. It has a Lock button.

Cluster **twist spread** parameter sets the maximum twist among the branches in a cluster [25...100deg].

Twist spread **random change** parameter sets the extent of variations in



the twist spread of branches in the cluster [0...100%] [UL/L]. It has a Lock button.

Heights - **hs** - parameter is a vertical bar with one dark green slider [0...100]. Its value is located on the left side of the bar (designated by a dark green dot). A value of one hundred corresponds to the full culm length. This slider sets the culm height at which the number of branches in the cluster equals the number set by the horizontal (dark green) “cluster progression” slider.

Cluster progression parameters are actually three horizontal sliders [LG/DG/CR] [1...5Br (branches)]. These sliders are designated with three different colors (light green, dark green, and crimson) and they set the number of branches in the cluster at the bottom branch producing node (light green), at the middle branch producing node (dark green, corresponds to dark green slider in the vertical “hs” bar), and at the top branch producing node (crimson). The number of branches in the clusters along the culm changes linearly towards the bottom and the top of the culm assuming the range of values between the values set by these three sliders.

- 000 -

Branch1 Cluster **Multi-Bud** button brings up Branch1 Multi-Bud window with multiple bud parameters. There can be up to 50 buds on one culm node. Each bud grows a cluster specified with parameters in Branch1 Cluster window.

Spread parameter sets the angular spread of cluster buds, and therefore branches, around the culm [0...180deg].



Spread **random change** parameter sets the extent of variations in the angular spread of cluster buds around the culm [0...20deg] [UL/L]. It has a Lock button.

Density parameter sets the number of cluster buds around the culm [1...50].

Density **random change** parameter sets the extent of variations in the number of cluster buds around the culm[0...100%] [UL/L]. It has a Lock button.

- 000 -

Branch1 **Angle** parameter sets the maximum angle of the first generation branches with reference to the culm axis. [0...90deg]. On double click it brings up Branch1 Angle window with additional branch angle parameters.

Random change parameter sets the extent of variations of branch angles [0...50deg] [UL/L]. It has a Lock button.

Linear change parameter sets the change of angles of the branches growing along the culm [0...80%]. If the value is zero then all branch angles are the same. If the value is 80% then the angle of subsequent branches diminishes towards the top of the culm. The branch at the top of the culm will have the angle which will equal 80% of the angle set by branch1 "Angle" parameter.

Linear change **starts at** parameter defines the culm height at which the branch angle starts to change [0...75%].

Node zig-zag parameter defines the zig-zag angle of internode sections



[0...10deg]. Zig-zagging of branches sometimes occurs because of the tensions in the nodes caused by the secondary branch growth.

- 000 -

Branch1 **Twist** parameter sets the twist angle of the first generation branches with reference to the culm's x-axis [0...360deg]. On double click it brings up Branch1 Twist window with additional branch twist parameters.

Random change for first branch sets the extent of variations for twist of the first branch in branch succession [0...100deg] [UL/L]. It has a Lock button.

Random change for successive branches sets the extent of variations for twists of successive branches [0...100deg] [UL/L]. It has a Lock button.

Progression parameter increments the twists of successive branches [0...10deg].

- 000 -

Branch1 **Curving** button brings up Branch1 Curving window with the parameters related to curvatures of the reference culm first generation branches and the first generation branches of other culms in the grove.

Heights - hs - parameter is a vertical bar with two sliders [0...100] [0...100]. Their values are shown on the left side of the bar. A value of one hundred corresponds to the full branch length. Those two sliders set three curving regions of the branch which can be curved independently. The three regions are designated with three different colors: light green,



dark green, and crimson.

Angles/change parameters are actually three pairs of sliders located to the right of the vertical “hs” bar.

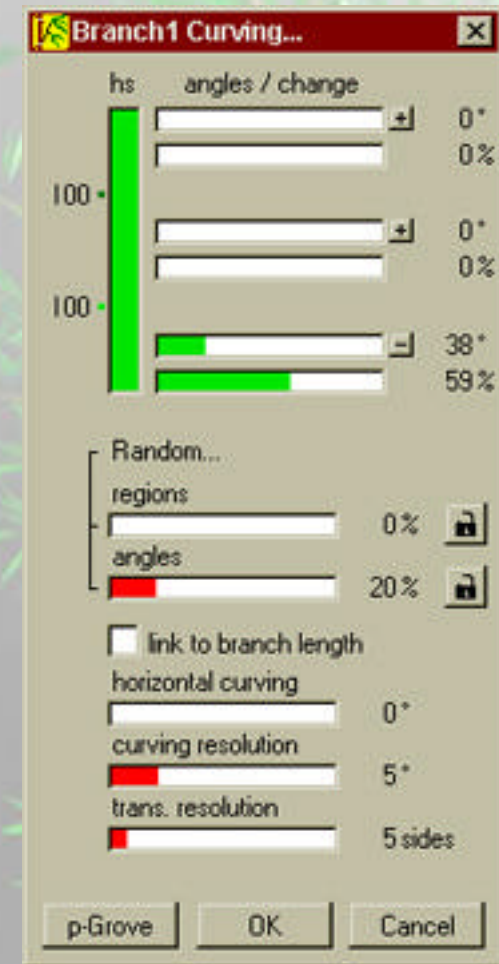
Angles parameters are the upper sliders of the three pairs [LG/DG/CR] [0...180deg] [+/-]. These sliders are designated with three different colors (light green, dark green, and crimson) and they control the curvatures of the corresponding curving regions. Example: if both hs sliders are set to 100, then there is only one region - LG - light green. Upper two horizontal sliders have no effect on this region. The bottom slider is the one that controls the curvature of the given region. +/- buttons to the right of these sliders set the direction of curving for the corresponding curving regions.

Change parameters are the lower sliders of the three pairs [LG/DG/CR] [0...100%]. These sliders change the curving angles set by the corresponding “angles” sliders.

Random regions parameter varies “hs” regions of curvature [0...100%] [UL/L]. It has a Lock button.

Random angles parameter varies curving angles set by the “angles” sliders [0...100%] [UL/L]. It has a Lock button.

Link to branch length parameter check box, when checked, links the curving regions to the length as set by the branch1 “Length” parameter. This means that the curving regions will be mapped to this branch length. As a result, the shorter branches along the culm will curve proportionally less than the longer ones. If unchecked, the curving regions will be linked to the length of the current branch. Hence, all first generation branches, be they short or long, will curve in similar fashion.



Horizontal curving parameter bends the first generation branches around the vertical axis [0...20deg].

Curving resolution parameter sets the minimum bending angle at which additional branch segmentation must occur to preserve the specified curving resolution [1...20deg]. The higher the value the less segments will be needed resulting in the smaller number of polygons.

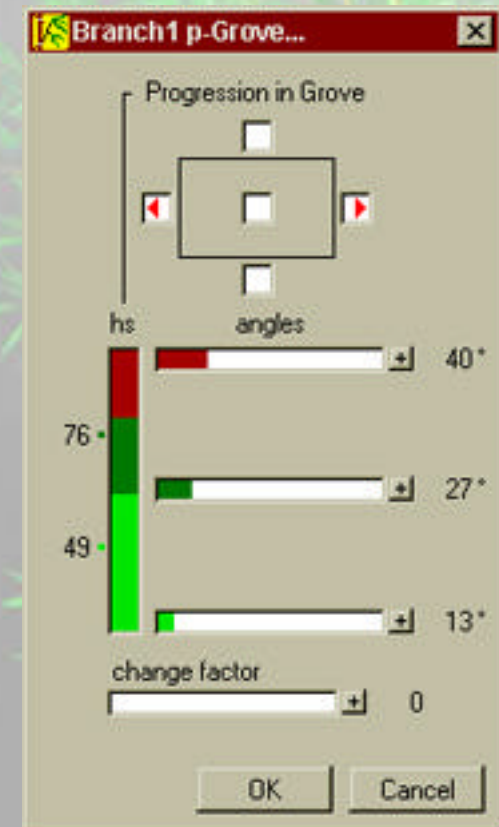
Trans. (transversal) resolution parameter sets the number of polygons around the circumference of the branch [3...32sides].

- 000 -

Pressing **p(progression in)-Grove** button in Branch1 Curving window brings the Branch1 p(progression in)-Grove parameter window with additional curving parameters that control curving changes for the first generation branches as a function of their parent culm's positions in a grove. The curving set with these parameters apply to the branches that grow from the culms at the perimeter of the grove. The curving changes occur gradually from the reference culm to the perimeter of the grove.

Progression in Grove parameter has five check boxes. L(ef), R(ight), N(ear), F(ar), and C(enter). They define the direction of curving changes for the first generation branches in a grove.

Heights - hs - parameter is a vertical bar with two sliders [0...100] [0...100]. Their values are shown on the left side of the bar. A value of one hundred corresponds to the full branch length. Those two sliders set three curving regions of the branch which can be curved independently. The three regions are designated with three different colors: light green,



dark green, and crimson.

Angles parameters are the three horizontal sliders to the right of the vertical “hs” slider [LG/DG/CR] [0...180deg] [+/-]. These sliders are designated with three different colors (light green, dark green, and crimson) and they control the curvatures of the corresponding curving regions.

Example: if both hs sliders are set to 100, then there is only one region - LG - light green. Upper two horizontal sliders have no effect on this region. The bottom slider is the one that controls the curvature of the given region. +/- buttons to the right of these sliders set the direction of curving for the corresponding curving regions.

Change factor parameter defines curving change for the first generation branches across the grove [0...100][+/-]. If it is set to zero then the change is linear. If it is set to + value then the change is concave, for - value the change is convex. The value of the parameter designates a degree of deviation from the linear change.

- 000 -

Branch1 **Color** parameter button brings up Branch1 Color window. Here you can set the color of the first generation branch internodes and nodes as well as its contrasts.

Random change parameter randomizes the RGB values of colors between starting (displayed in the left box) and ending color (displayed in the right box) [0...100%] [UL/L]. It has a Lock button.

Internode palette shows the colors on the branch internodes if any of the two contrast are checked. Two boxes to the left and to the right of the palette show starting and ending colors and are mouse activated. When

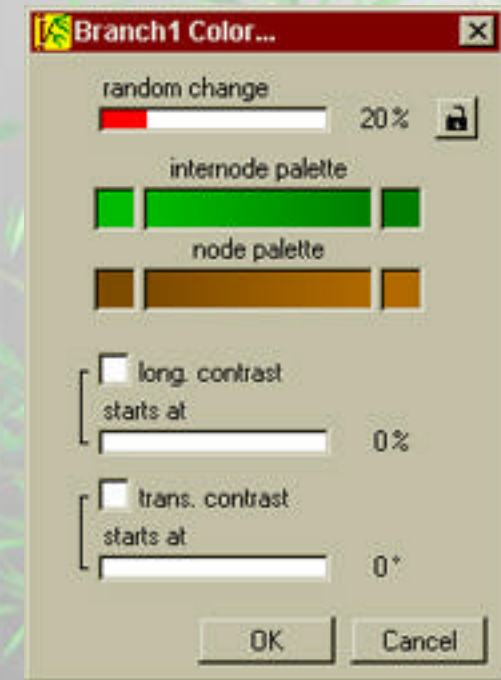
any of the two is selected, it brings up standard Windows color picker, where you can select a desired color. The palette will display the colors in between the two colors shown in the left and right boxes. If longitudinal and transversal contrasts are not active, the branch internodes assume the starting color (shown in the left box), otherwise they assume the range of colors shown in the palette.

Node palette shows the colors on the branch nodes if any of the two contrast are checked. Two boxes to the left and to the right of the palette show starting and ending colors and are mouse activated. When any of the two is selected, it brings up standard Windows color picker, where you can select a desired color. The palette will display the colors in between the two colors shown in the left and right boxes. Branch nodes assume the range of colors shown in the palette.

Long. (longitudinal) contrast checkbox enables longitudinal contrast [UC/C]. Longitudinal contrast applies the internode palette colors from the bottom to the top of the branch and it applies the node palette colors from the top and bottom edges of each node to its center. Longitudinal contrast for the nodes is always applied.

Long. contrast **starts at** parameter defines the height of the branch at which the color starts to change [0...100%]. If it is fifty, for example, then the bottom half of the branch will have the starting color (shown in the box to the left of the color palette) and the colors of the top half of the branch will gradually change from the starting color to the ending color (shown in the box to the right of the color palette).

Trans. (transversal) contrast checkbox enables transversal contrast function [UC/C]. Transversal contrast applies the internode palette colors



around the circumference of branch internodes and it applies the node colors around the circumference of each branch node.

Trans. contrast **starts at** parameter defines the angle along the branch circumference at which the branch color starts to change if transversal contrast is active [0...360deg].

- 000 -

Branch1 **Growth** parameter window contains parameters related to the growth of first generation branches.

Random change parameter sets the extent of variations in the speed of branch growth [0...100%] [UL/L]. It has a Lock button.

Speed parameter sets the branch growth speed [1...100] [cm/M(month), cm/d(day)].

Node activation sets the rate at which successive nodes appear on the branch during its growth [0...100%]. If it is zero then all the nodes appear at the same time. If greater than zero then the successive nodes will follow each other with delay.

Node activation **successive delays** parameter defines the dormancy time of the successor node [0...100days].

Positioning shorten/prolong parameter sets the time it takes the branch to achieve the terminal angle with respect to its parent culm [0...100%][+/-].

Positioning random change parameter sets the extent of variations in the times set by the "shorten/prolong" parameter [0...100%] [UL/L]. It has



a Lock button.

Cluster growth starts as the culm elongates parameter commands BAMBOO to start growing child branches while the culm elongates [UC/C].

Cluster growth starts after the culm's elongation parameter commands BAMBOO to start growing child branches after the culm has completely elongated [C/UC].

After the culm's elongation **starts at** parameter sets the culm height at which the first branch cluster starts to appear after the culm has been completely elongated [0...100%]. When zero, the clusters appear from the culm bottom up. When set to hundred, they appear from the culm top down.

After the culm's elongation **initial delay** parameter sets growth delay of the first branch cluster to appear after the culm has been completely elongated [0...100days (or weeks)].

After the culm's elongation **successive delays** parameter sets growth delays of subsequent branch clusters after the culm has been completely elongated [0...100days].





Branch2+ Parameters

BAMBOO branch2+ parameters are activated by pressing the Branch2+ button in the Group levels section. That brings up the following top level and subsequent level parameters:

Random Seed “

Randomize...

Bamboo

Grove

Growth

Length “

Random change, UL/L

Hs (heights)

Top region change

Top region linear r.(reduction)

Max.(maximum) length

Bottom region change

Bottom region linear r.(reduction)

Link to parent length

To minimum

I-gen (inter-generation) reduction

Width

Node

Model node

Break node

Upper extension

Middle extension

Lower extension

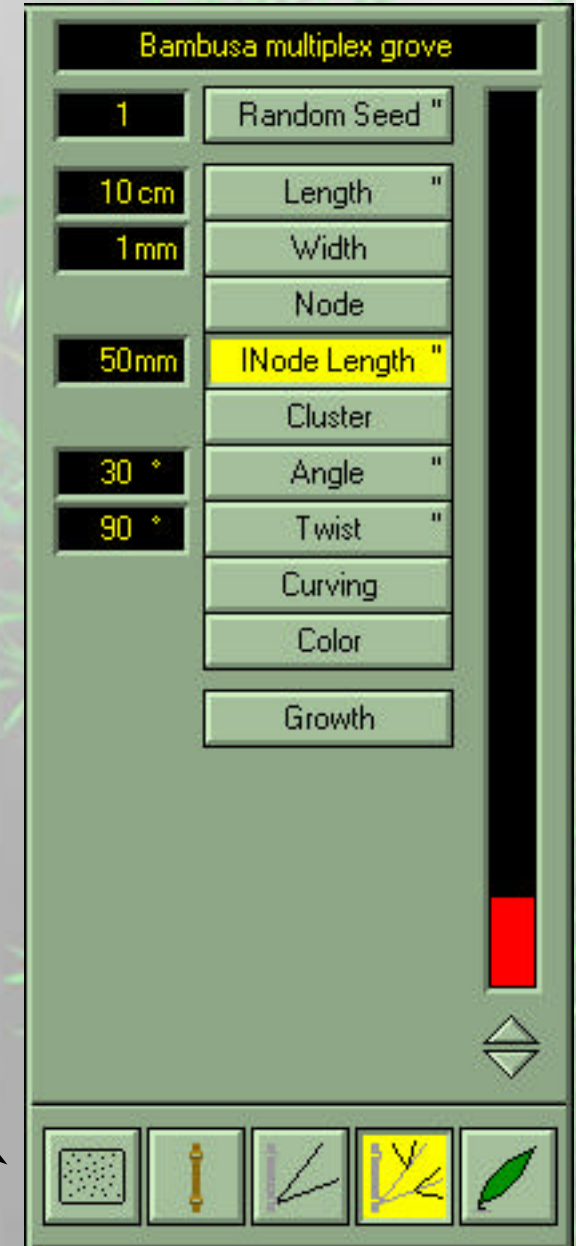
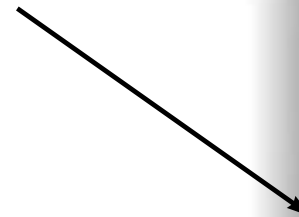
Upper width

Middle width

Lower width

Branching...

Group level buttons



- Zone, R/B
 - I(inter)-generation change, +/-
 - Random change, UL/L
- INode (internode) Length “
 - Random change, UL/L
 - Top reduction
 - To min.(minimum) length
 - Starts at
 - Link to branch length
 - To minimum
 - I-gen.(inter-generation) reduction
- Cluster
 - T(terminal)-generation
 - Sky sensitive
 - Leader dominance, R/B
 - Random change, UL/L
 - Cluster angle spread
 - Random change, UL/L
 - Cluster twist spread
 - Random change, UL/L
 - Hs (heights)
 - Region M
 - Cluster progression
 - Region T
 - Region M
 - Region B
- Multi-Bud
 - Spread
 - Random change, UL/L
 - Density
 - Random change, UL/L
- Angle “
 - Random change, UL/L
 - Linear change



Starts at
Node zig-zag
Twist “
Random Change for...
First branch, UL/L
Successive branches, UL/L
Progression for...
S(successive)-generation
I(inter)-generation
Curving
Hs(heights)
T-M border
M-B border
Angles/change
Region T
Region M
Region B
Random...
Regions, UL/L
Angles, UL/L
Link to branch length, UC/C
Horizontal curving
Curving resolution
Trans.(transversal) resolution
P(progression in)-Grove
Progression in grove
L/R/F/B/C
Hs(heights)
T-M border
M-B border
Angles
Region T
Region M
Region B



Change factor

Color

- Random change, UL/L
- Internode palette, S/E
- Node palette, S/E
- Long.(longitudinal) contrast, UC/C
 - Starts at
- Trans.(transversal) contrast, UC/C
 - Starts at

Growth

- Random change, UL/L
- Speed
- Node activation
 - Successive delays
- Positioning
 - Shorten/prolong, +/-
 - Random change, UL/L
- Cluster growth starts...
 - As the parent elongates, UC/C
 - After the parent's elongation, C/UC
 - Starts at
 - Initial delay
 - Successive delays

- 000 -

Random Seed parameter enables you to create different instances of the same bamboo by changing its value [1...1000]. On double click, it brings up Random Seed window with three parameters that randomize the bamboo, the bamboo grove, and the bamboo growth. This window is accessible on all five Group levels, i.e. Grove, Culm, Branch1, Branch2+, and Foliage level. Detailed description of these global parameters is located on page 29.



Branch2+ **Length** parameter sets the maximum length of the second generation branches and all subsequent generations of branches [0...500cm]. The second generation branches are those that grow from the first generation branches. When double clicked it brings up Branch2+ Length window with parameters related to branch2+ lengths.

Random change parameter sets the extent of length variations of the second+ branches on a single bamboo as well as on the multiple bamboos in a grove [0...50%] [UL/L]. It has a Lock button.

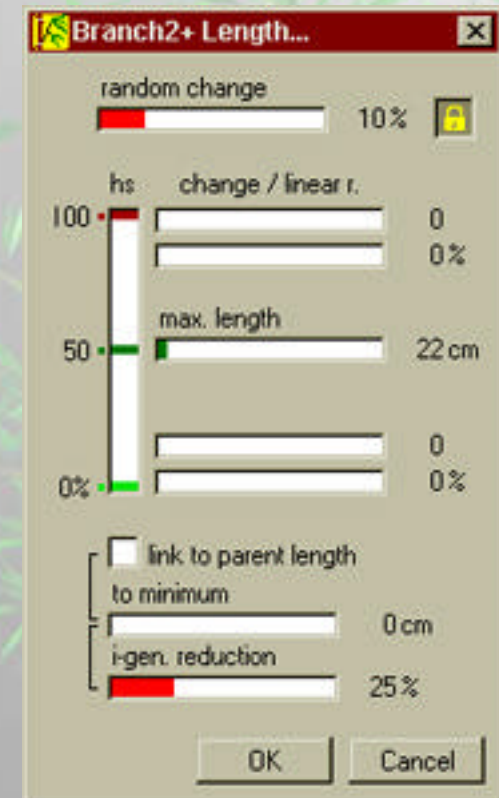
Heights - hs - parameter is a vertical bar with one dark green slider [0...100]. Its value is located on the left side of the bar (designated by a dark green dot). A value of one hundred corresponds to the full parent branch length. This slider sets the parent branch height at which the longest child branch springs out.

Change/linear r. (reduction) parameters are actually two pairs of sliders located to the right of the top and the bottom of the vertical “hs” bar.

The top **change** slider (in crimson color) modulates the lengths of child branches towards the top of the parent branch [0..100]. This slider is inactive if any of the two “linear r.” sliders is set to a non-zero value.

The bottom **change** slider (in light green color) modulates the lengths of child branches towards the bottom of the parent branch [0..100]. This slider is inactive if any of the two “linear r.” sliders is set to a non-zero value.

The top **linear r.** slider (in crimson color) sets the reduction of the child



branch length that springs out at the top of the parent branch [0...100%]. This slider is inactive if any of the two “change” sliders is set to a non-zero value.

The bottom **linear r.** slider (in light green color) sets the reduction of the child branch length that springs out at the bottom of the parent branch [0...100%]. This slider is inactive if any of the two “change” sliders is set to a non-zero value.

Max. (maximum) length parameter (the dark green slider between the top and bottom “change/linear r.” slider pairs) sets the maximum length of the second+ generation branches [0...500cm].

Link to parent length parameter check box, when checked, links the maximum branch length to the branch1 length as set by the branch1 “Length” parameter. This means that other parent branches that have smaller lengths will produce child branches that are proportionally shorter [UC/C].

Link to parent length **to minimum** parameter sets the minimum branch length allowed if “link to parent length” is checked or “i-gen. reduction” is greater than zero [0...VARmm].

I-gen.(inter-generation) reduction parameter sets the reduction percentage for the lengths of child branches with respect to their parent branch [0...90%].

- 000 -

Width parameter sets the width of the longest second generation branch [1... 50mm]. Note that the second generation branch cannot be thicker

than its parent branch. The same is valid for all subsequent branch generations.

- 000 -

Pressing the branch2+ **Node** button opens the window with branch2+ node parameters.

Model node, when checked, commands BAMBOO to model branch2+ nodes [UC/C]. “Model node” should be checked for closeup renderings. A node is comprised of three cylindrical (or conical) sections - upper, middle, and lower section or part. Each cylinder has its length or extension and its width.

Break node, when checked, commands BAMBOO to segment (break) the branch2+ at nodes [C/UC]. Only when the branch2+ is segmented at nodes, the nodes can be modeled, i.e. when “break node” is not checked, “model node” is unchecked and dimmed.

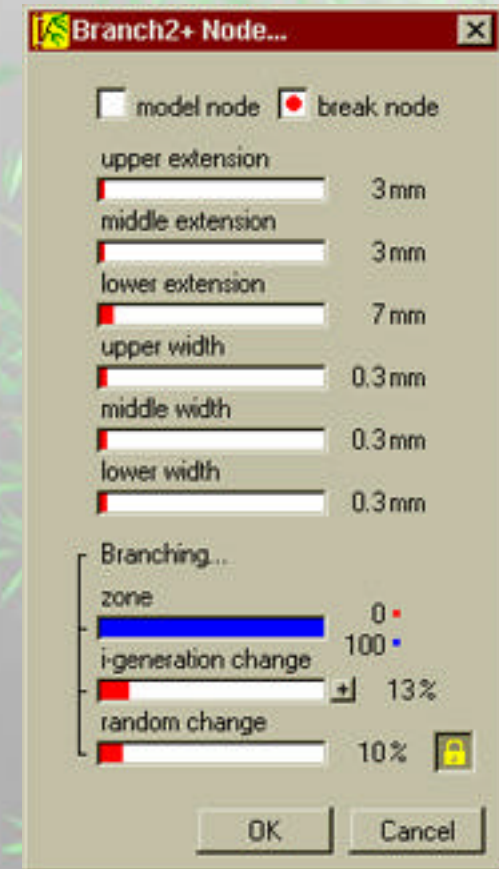
Upper extension parameter sets the length of an upper part of modeled node [1...100mm].

Middle extension parameter sets the length of a middle part of modeled node [1...100mm].

Lower extension parameter sets the length of a lower part of modeled node [1...100mm].

Upper width parameter sets the width of an upper part of modeled node [0...90mm].

Middle width parameter sets the width of a middle part of modeled node [0...90mm].



Lower width parameter sets the width of a lower part of modeled node [0...90mm].

Branching zone parameter has two sliders: red and blue. The red slider sets the branch2+ height below which the nodes do not grow child branches, i.e. the bottom non-branching zone. The blue slider sets the branch2+ height above which there are no child branches, i.e. the top non-branching zone. The nodes are there but there are no branches. Branches grow only between the values of red and blue slider [0...100, R/B].

Branching zone **i(inter)-generation change** parameter sets the change for the bottom branching zones of child branches with respect to their parent branch [0...100%][+/-]. +/- button to the right of the slider designates whether bottom non-branching zones of each subsequent generation of branches will increase or decrease.

Branching zone **random change** parameter randomizes the values set by the branching zone parameters [0...100%] [UL/L]. It has a Lock button.

- 000 -

INode (internode) Length parameter sets the distance between adjacent branch2+ nodes [1...500mm]. On double click it brings up Branch2 Internode Length window with additional internode parameters.

Random change parameter sets the extent of variations of the internode lengths [0...50%] [UL/L]. It has a Lock button.

Top reduction parameter reduces the internode lengths toward the top

of the branch2+ [0...100]. For 0 value there is no reduction.

Top reduction **to min. (minimum) length** parameter defines the minimum internode length to be reduced with the “top reduction” parameter [10...100mm]. The internode cannot be shorter than the one set here.

Top reduction **starts at** parameter sets the height of the branch2+ above which the internodes get gradually reduced in length [50...100%].

Link to branch length parameter check box, when checked, links the maximum internode length to the branch length as set by the branch2+ “Length” parameter. This means that other branches of the same generation or the ones of subsequent generations that have smaller height will have internodes that are proportionally shorter [UC/C].

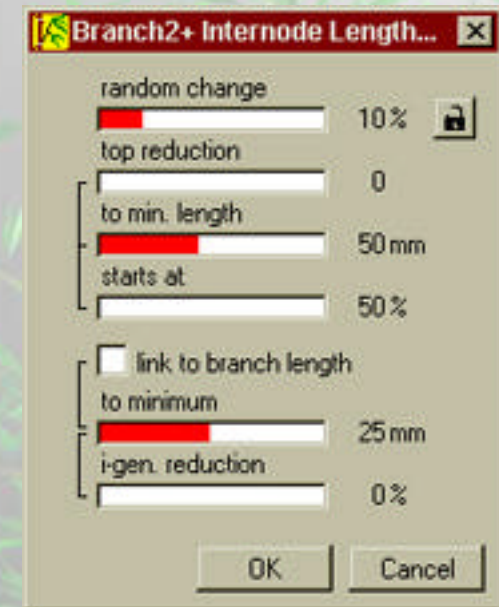
Link to branch length **to minimum** parameter sets the minimum internode length allowed if “link to branch length” is checked or “i-gen. reduction” is greater than zero [1...VARmm].

I-gen.(inter-generation) reduction parameter sets the reduction percentage for the internodes of child branches with respect to their parent branch [0...90%].

- 000 -

Branch2+ **Cluster** button brings up Branch2+ Cluster window with branch2+ cluster parameters. Cluster is a bunch of branches growing from the same parent branch node.

T(terminal) generation parameter sets the maximum number of branch2+ generations of branches [0...5].



Sky sensitive parameter forces the downward growing branches of the second and subsequent generations to grow upward towards the sky [0...100%].

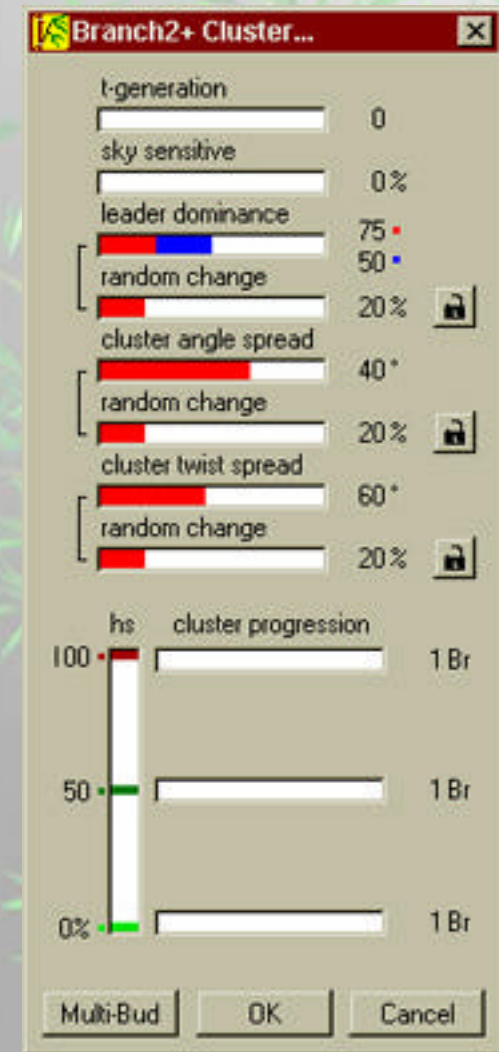
Leader dominance is a double slider [100...0] [100...0]. If there are two or more branches in a cluster then the red slider adjusts the length of the two second tier inferior branches, and the blue slider adjusts the length of the two first tier inferior branches with respect to the dominant branch on this parent branch node. If the blue value is set to 100 then the first tier branches have the same length as the dominant branch. If the blue value is set to zero then the two first tier inferior branches have zero length. If the red value is set to 100 then the second tier branches have the same length as the dominant branch. If the red value is set to zero then the two second tier inferior branches have zero length. The second tier branches in the cluster cannot exceed the length of the first tier branches.

Leader dominance **random change** parameter sets the extent of variations in the lengths of inferior branches in the cluster [0...100%] [UL/L]. It has a Lock button.

Angle spread parameter sets the maximum angle among the branches in a cluster [20...50deg].

Angle spread **random change** parameter sets the extent of variations in the angle spread of branches in the cluster [0...100%] [UL/L]. It has a Lock button.

Twist spread parameter sets the maximum twist among the branches in a cluster [25...100deg].



Twist spread **random change** parameter sets the extent of variations in the twist spread of branches in the cluster [0...100%] [UL/L]. It has a Lock button.

Heights - hs - parameter is a vertical bar with one dark green slider [0...100]. Its value is located on the left side of the bar (designated by a dark green dot). A value of one hundred corresponds to the full parent branch length. This slider sets the parent branch height at which the number of child branches in the cluster equals the number set by the horizontal (dark green) “cluster progression” slider.

Cluster progression parameters are actually three horizontal sliders [LG/DG/CR] [1...5Br (branches)]. These sliders are designated with three different colors (light green, dark green, and crimson) and they set the number of branches in the cluster at the bottom branch producing node (light green), at the middle branch producing node (dark green, corresponds to dark green slider in the vertical “hs” bar), and at the top branch producing node (crimson). The number of branches in the clusters along the parent branch changes linearly towards the bottom and the top of the parent branch assuming the range of values between the values set by these three sliders.

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Branch2+ Cluster **Multi-Bud** button brings up Branch2+ Multi-Bud window with multiple bud parameters. There can be up to 50 buds on one culm node. Each bud grows a cluster specified with parameters in Branch2+ Cluster window.

Spread parameter sets the angular spread of cluster buds, and therefore branches, around the parent branch [0...180deg].



Spread **random change** parameter sets the extent of variations in the angular spread of cluster buds around the parent branch [0...20deg] [UL/L]. It has a Lock button.

Density parameter sets the number of cluster buds around the parent branch [1...50].

Density **random change** parameter sets the extent of variations in the number of cluster buds around the parent branch [0...100%] [UL/L]. It has a Lock button.

- 000 -

Branch2+ **Angle** parameter sets the maximum angle of the second and subsequent generation branches with reference to their parent branch axis. [0...90deg]. On double click it brings up Branch2+ Angle window with additional branch angle parameters.

Random change parameter sets the extent of variations of branch angles [0...10deg] [UL/L]. It has a Lock button.

Linear change parameter sets the change of angles of the child branches growing along the same parent branch [0...80%]. If the value is zero then all branch angles are the same. If the value is 80% then the angle of subsequent branches diminishes towards the top of the parent branch. The branch at the top of the parent branch will have the angle which will equal 80% of the angle set by branch2+ "Angle" parameter.

Linear change **starts at** parameter defines the parent branch height at which the branch angle starts to change [0...75%].



Node zig-zag parameter defines the zig-zag angle of internode sections [0...10deg]. Zig-zagging of branches sometimes occurs because of the tensions in the nodes caused by the children branch growth.

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Branch2+ **Twist** parameter sets the twist angle of the second and subsequent generation branches with reference to the parent's x-axis [0...360deg]. On double click it brings up Branch2+ Twist window with additional branch twist parameters.

Random change for first branch sets the extent of variations for twist of the first branch in the branch succession belonging to the same parent [0...100deg] [UL/L]. It has a Lock button.

Random change for successive branches sets the extent of variations for twists of successive branches belonging to the same parent [0...100deg] [UL/L]. It has a Lock button.

Progression for s(single)-generation parameter increments the twists of successive branches belonging to the same generation [0...10deg].

Progression for i(inter)-generation parameter increments the twists of branches of successive generations [0...20deg].

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Branch2+ **Curving** button brings up Branch2+ Curving window with the parameters related to curvatures of the reference culm second+ generation branches and the second+ generation branches of other culms in a grove.



Heights - hs - parameter is a vertical bar with two sliders [0...100] [0...100]. Their values are shown on the left side of the bar. A value of one hundred corresponds to the full branch length. Those two sliders set three curving regions of the branch which can be curved independently. The three regions are designated with three different colors: light green, dark green, and crimson.

Angles/change parameters are actually three pairs of sliders located to the right of the vertical “hs” bar.

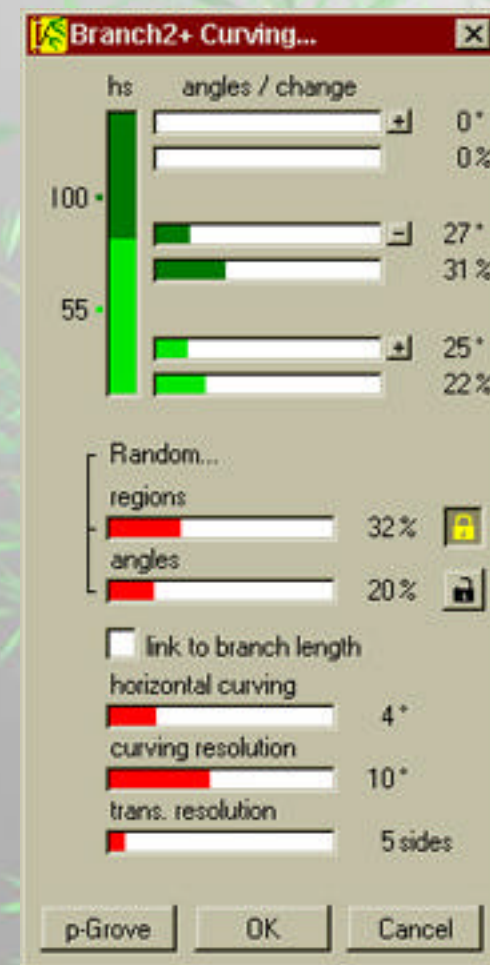
Angles parameters are the upper sliders of the three pairs [LG/DG/CR] [0...180deg] [+/-]. These sliders are designated with three different colors (light green, dark green, and crimson) and they control the curvatures of the corresponding curving regions. Example: if both hs sliders are set to 100, then there is only one region - LG - light green. Upper two horizontal sliders have no effect on this region. The bottom slider is the one that controls the curvature of the given region. +/- buttons to the right of these sliders set the direction of curving for the corresponding curving regions.

Change parameters are the lower sliders of the three pairs [LG/DG/CR] [0...100%]. These sliders change the curving angles set by the corresponding “angles” sliders.

Random regions parameter varies “hs” regions of curvature [0...100%] [UL/L]. It has a Lock button.

Random angles parameter varies curving angles set by the “angles” sliders [0...100%] [UL/L]. It has a Lock button.

Link to branch length parameter check box, when checked, links the



curving regions to the length as set by the branch2+ “Length” parameter. This means that the curving regions will be mapped to this branch length. As a result, the shorter branches will curve proportionally less than the longer ones. If unchecked, the curving regions will be linked to the length of the current branch. Hence, all second+ generation branches, be they short or long, will curve in similar fashion.

Horizontal curving parameter bends the second+ generation branches around the vertical axis [0...20deg].

Curving resolution parameter sets the minimum bending angle at which additional branch segmentation must occur to preserve the specified curving resolution [1...20deg]. The higher the value the less segments will be needed resulting in the smaller number of polygons.

Trans. (transversal) resolution parameter sets the number of polygons around the circumference of the branch [3...32sides].

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Pressing **p(progression in)-Grove** button in Branch2+ Curving window brings the Branch2+ p(progression in)-Grove parameter window with additional curving parameters that control curving changes for the second and subsequent generation branches as a function of their parent culm's position in a grove. The curving set with these parameters apply to the branches that grow from the culms at the perimeter of the grove. The curving changes occur gradually from the reference culm to the perimeter of the grove.

Progression in Grove parameter has five check boxes. L(ef), R(ight), N(ear), F(ar), and C(enter). They define the direction of curving changes



for the second and subsequent generation branches in a grove.

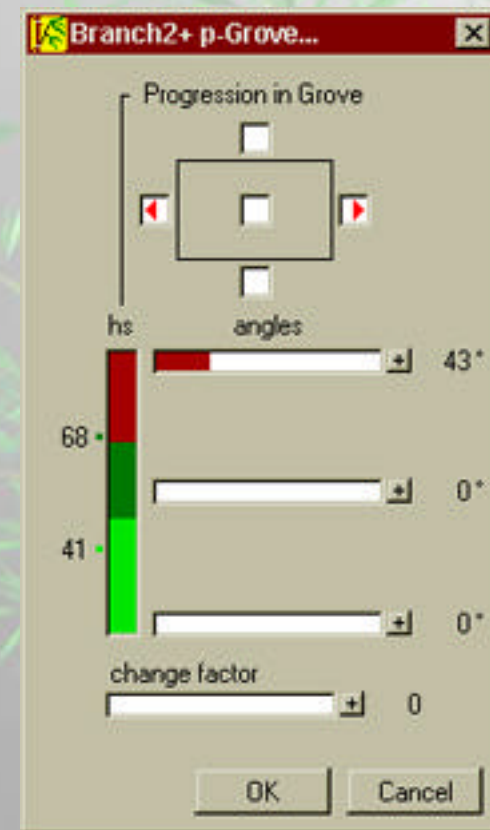
Heights - hs - parameter is a vertical bar with two sliders [0...100] [0...100]. Their values are shown on the left side of the bar. A value of one hundred corresponds to the full branch length. Those two sliders set three curving regions of the branch which can be curved independently. The three regions are designated with three different colors: light green, dark green, and crimson.

Angles parameters are the three horizontal sliders to the right of the vertical "hs" slider [LG/DG/CR] [0...180deg] [+/-]. These sliders are designated with three different colors (light green, dark green, and crimson) and they control the curvatures of the corresponding curving regions. Example: if both hs sliders are set to 100, then there is only one region - LG - light green. Upper two horizontal sliders have no effect on this region. The bottom slider is the one that controls the curvature of the given region. +/- buttons to the right of these sliders set the direction of curving for the corresponding curving regions.

Change factor parameter defines curving change for the second and subsequent generation branches across the grove [0...100][+/-]. If it is set to zero then the change is linear. If it is set to + value then the change is concave, for - value the change is convex. The value of the parameter designates a degree of deviation from the linear change.

- 000 -

Branch2+ **Color** parameter button brings up Branch2+ Color window. Here you can set the color of the second and subsequent generation branch internodes and nodes as well as its contrasts.



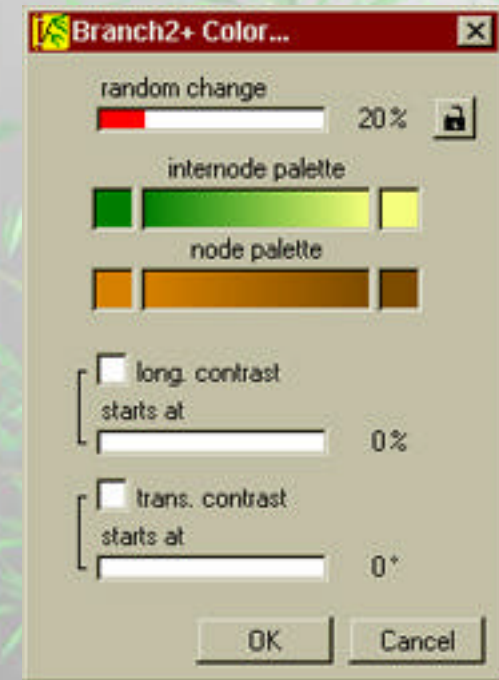
Random change parameter randomizes the RGB values of colors between starting (displayed in the left box) and ending color (displayed in the right box) [0...100%] [UL/L]. It has a Lock button.

Internode palette shows the colors on the branch internodes if any of the two contrast are checked. Two boxes to the left and to the right of the palette show starting and ending colors and are mouse activated. When any of the two is selected, it brings up standard Windows color picker, where you can select a desired color. The palette will display the colors in between the two colors shown in the left and right boxes. If longitudinal and transversal contrasts are not active, the branch internodes assume the starting color (shown in the left box), otherwise they assume the range of colors shown in the palette.

Node palette shows the colors on the branch nodes if any of the two contrast are checked. Two boxes to the left and to the right of the palette show starting and ending colors and are mouse activated. When any of the two is selected, it brings up standard Windows color picker, where you can select a desired color. The palette will display the colors in between the two colors shown in the left and right boxes. Branch nodes assume the range of colors shown in the palette.

Long. (longitudinal) contrast checkbox enables longitudinal contrast [UC/C]. Longitudinal contrast applies the internode palette colors from the bottom to the top of the branch and it applies the node palette colors from the top and bottom edges of each node to its center. Longitudinal contrast for the nodes is always applied.

Long. contrast **starts at** parameter defines the height of the branch at which the color starts to change [0...100%]. If it is fifty, for example, then



the bottom half of the branch will have the starting color (shown in the box to the left of the color palette) and the colors of the top half of the branch will gradually change from the starting color to the ending color (shown in the box to the right of the color palette).

Trans. (transversal) contrast checkbox enables transversal contrast function [UC/C]. Transversal contrast applies the internode palette colors around the circumference of branch internodes and it applies the node colors around the circumference of each branch node.

Trans. contrast **starts at** parameter defines the angle along the branch circumference at which the branch color starts to change if transversal contrast is active [0...360deg].

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Branch2+ **Growth** parameter window contains parameters related to the growth of second and subsequent generation branches.

Random change parameter sets the extent of variations in the speed of branch growth [0...100%] [UL/L]. It has a Lock button.

Speed parameter sets the branch growth speed [1...100] [cm/M(month), cm/d(day)].

Node activation sets the rate at which successive nodes appear on the branch during its growth [0...100%]. If it is zero then all the nodes appear at the same time. If greater than zero then the successive nodes will follow each other with delay.

Node activation **successive delays** parameter defines the dormancy time of the successor node [0...100days].

Positioning shorten/prolong parameter sets the time it takes the branch to achieve the terminal angle with respect to it's parent branch [0...100%][+/-].

Positioning random change parameter sets the extent of variations in the times set by the "shorten/prolong" parameter [0...100%] [UL/L]. It has a Lock button.

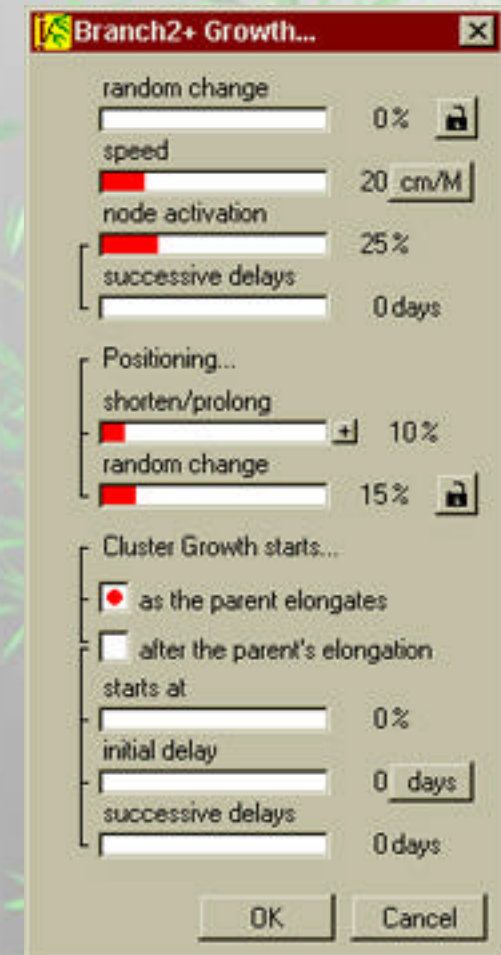
Cluster growth starts as the parent elongates parameter commands BAMBOO to start growing child branches while the parent branch elongates [UC/C].

Cluster growth starts after the parent's elongation parameter commands BAMBOO to start growing child branches after the parent branch has completely elongated [C/UC].

After the parent's elongation **starts at** parameter sets the parent branch height at which the first branch cluster starts to appear after the parent branch has been completely elongated [0...100%]. When zero, the clusters appear from the parent branch bottom up. When set to hundred, they appear from the parent branch top down.

After the parent's elongation **initial delay** parameter sets growth delay of the first branch cluster to appear after the parent branch has been completely elongated [0...100days (or weeks)].

After the parent's elongation **successive delays** parameter sets growth delays of subsequent branch clusters after the parent branch has been completely elongated [0...100days].





Foliage Parameters

BAMBOO foliage parameters are activated by pressing the Branch1 button in the Group levels section. That brings up the following top level and subsequent level parameters:

Random Seed “

Randomize...

Bamboo

Grove

Growth

Type

Heights along the leaf length

E-M border

M-S border

Leaf end concavity

Leaf beginning concavity

Leaf length

Leaf width

Outline resolution

Simple (leaf shape), C/UC

With midrib, UC/C

Break along midrib, UC/C

Plates, UC/C

Number

Random change, UL/L

Length “

Hs(heights) border, 1

Length at end

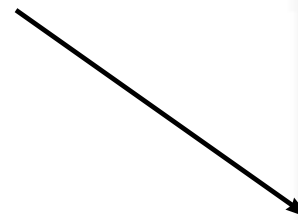
Leaf length

Length at start

Random Change for...

initial leaf, UL/L

Group level buttons



Bambusa multiplex grove	
1	Random Seed "
	Type
5	Number "
140mm	Length "
20mm	Width
10mm	Petiole Length
2mm	Petiole Width
10mm	Leaf Length "
57 °	Angle "
90 °	Twist "
	Curving
	Color
	Growth

Group level buttons

Bottom icons: [Grid] [Branch] [Leaf] [Venn] [Yellow Leaf]

- successive leaves, UL/L
- Link to internode length, UC/C
 - To minimum
- Link to parent length, UC/C
 - To minimum

Width

Petiole Length

Petiole Width

Leaf (interleaf) Length “

- Interleaf Length...

- Random change, UL/L

- I-gen (inter-generation) reduction

- I-cluster (inter-cluster) reduction, UC/C

- To min interleaf length

- Sheath length

- Random change, UL/L

- I-gen (inter-generation) reduction

- I-cluster (inter-cluster) reduction, UC/C

- To min sheath length

Angle “

- Random change, UL/L

- Roll mirror

- Progression

- Random change, UL/L

- Active region when...

- Sky sensitive off

- Sky sensitive on

Twist “

- Random change, UL/L

- Sky Sensitive for...

- Single leaves

- Leaf groups

- Random Roll for...

- Single leaves, UL/L



Leaf groups, UL/L

Curving

Hs(heights)

T-M border

M-B border

Angles

Region T, +/-

Region M, +/-

Region B, +/-

Change

Region T, +/-

Region M, +/-

Region B, +/-

Random...

Regions, UL/L

Angles, UL/L

Extreg1, UL/L

Link to leaf length, UC/C

Clip to 180deg

Curving resolution

Color

Random change, UL/L

Leaf palette, S/E

Long.(longitudinal) contrast, UC/C

Starts at

Growth

Random change, UL/L

Leaf activation

Elongation...

Speed

Extend

Opening...

Speed

Hold



Positioning...
Speed
Hold

- 000 -

Random Seed parameter enables you to create different instances of the same bamboo by changing its value [1...1000]. On double click, it brings up Random Seed window with three parameters that randomize the bamboo, the bamboo grove, and the bamboo growth. This window is accessible on all five Group levels, i.e. Grove, Culm, Branch1, Branch2+, and Foliage level. Detailed description of these global parameters is located on page 29.

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Leaf **Type** button brings up Leaf Type window with parameters for bamboo leaf shape.

Heights - hs - parameter is a vertical bar with two sliders [10...90] [10...90]. They are designated with dark green and crimson colors. Their values are located on the left side of the bar (designated with dark green and crimson dots). A value of one hundred corresponds to the full leaf length. Those two sliders set three outline regions of the leaf which can be manipulated independently.

End concavity is a horizontal slider located just above the small preview display [10...200]. This parameter sets the outline concavity of the third (top) region of the leaf. If set to 20, for example, the leaf's top part will be rounded and the value of 200 will result in a very sharp top part.

Beginning concavity is a horizontal slider located just below the small



preview display [10...200]. This parameter sets the outline concavity of the first (bottom) region of the leaf. If set to 20, for example, the leaf's bottom part will be rounded and the value of 200 will result in a very sharp bottom part.

Leaf length parameter sets the leaf length [10...600mm].

Leaf width parameter sets the leaf width [1...100mm].

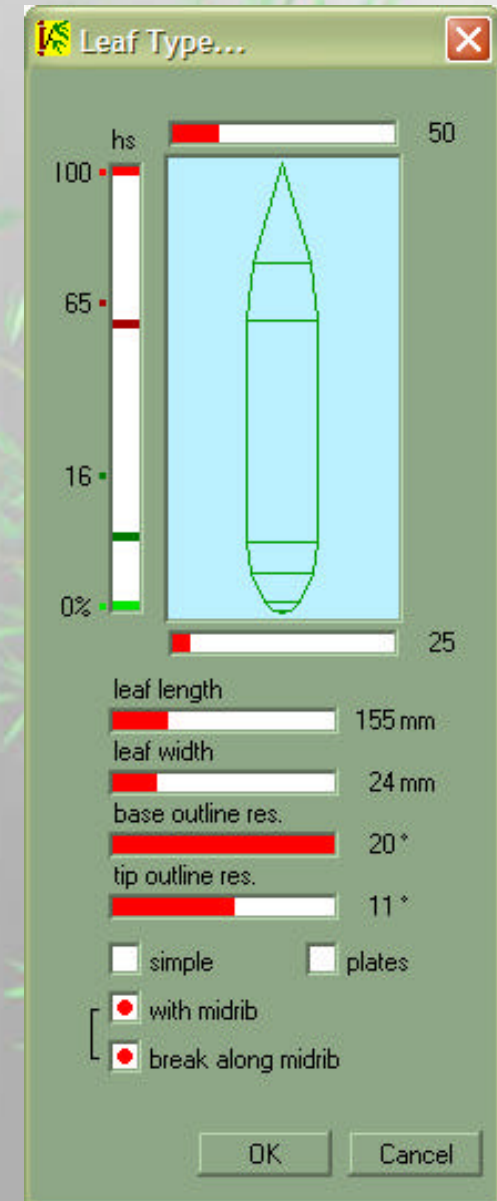
Base outline resolution parameter sets the minimum bending angle at the leaf base at which additional leaf segmentation must occur to preserve specified outline resolution [1...20deg]. The higher the value the less segments will be needed resulting in the smaller number of polygons.

Tip outline resolution parameter sets the minimum bending angle at the leaf tip at which additional leaf segmentation must occur to preserve specified outline resolution [1...20deg]. The higher the value the less segments will be needed resulting in the smaller number of polygons.

Simple leaf shape, when checked, commands BAMBOO to model leaves with two polygons [I/O].

With midrib, when checked, commands BAMBOO to model leaves broken at their midribs [I/O]. If the leaves are modeled as non-simple, this option will double their polygon number. The polygon number of the simple leaves will stay the same.

Break along midrib works in concert with “with midrib” parameter. If “with midrib” is checked then this parameter, when checked, commands BAMBOO to model leaves so that they are slightly slanted along their



midribs [I/O].

Plates, when checked, commands BAMBOO to model leaves as sequences of rectangular polygons (“plates”) where all the polygons have the same width [I/O]. This gives the leaves a ribbon-like look. The “plates” should be used if one wants to texture map the leaf objects with the images of “real” leaves.

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Leaf **Number** parameter sets the number of leaves on the parent branch [1...30]. On double click it brings up Leaf Number window.

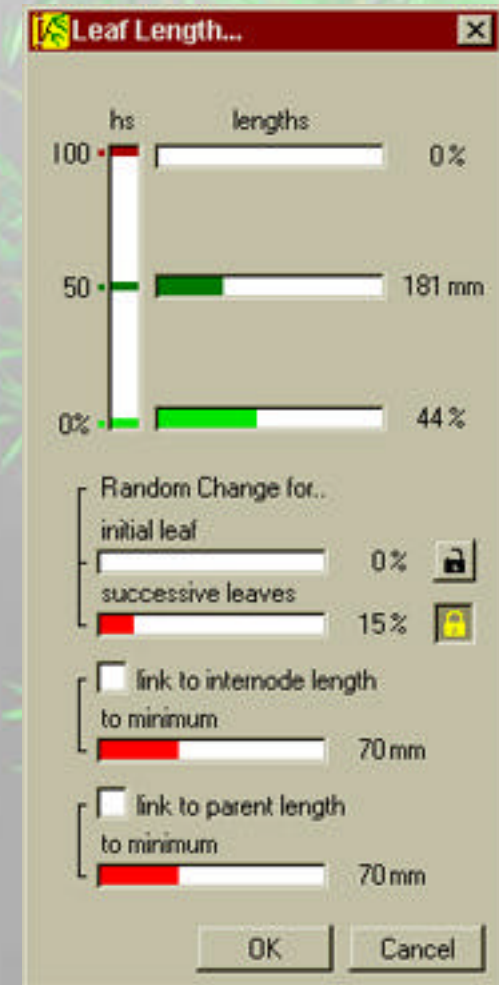
Random change parameter sets the extent of variations in the number of leaves per branch [0...10] [UL/L]. It has a Lock button.

- 000 -

Leaf **Length** parameter sets the maximum length for the leaves [10...600mm]. When double clicked it brings up Leaf Length window with additional parameters related to leaf length.

Heights - hs - parameter is a vertical bar with one dark green slider [0...100]. Its value is located on the left side of the bar (designated by a dark green dot). A value of one hundred corresponds to the leaf carrying length of the parent branch. This slider sets the height at which the longest leaf springs out.

Lengths parameters are actually three horizontal sliders located to the right of the vertical “hs” bar. These sliders are designated with three different colors (light green, dark green, and crimson) and they set the lengths at the bottom (light green), middle (dark green), and top (crim-



son) of the leaf carrying part of the parent branch. The top length slider (crimson) sets the length reduction with respect to the maximum length [0..100%]. The middle length slider (dark green) sets the maximum leaf length (same as leaf “Length” parameter) [10...600mm]. The bottom length slider (light green) sets the length reduction with respect to the maximum length [0..100%].

Random Change for initial leaf sets the extent of variations in length of the first leaf in a leaf group belonging to the same parent branch [0..100%] [UL/L]. It has a Lock button.

Random Change for successive leaves sets the extent of variations in lengths of successive leaves in a leaf group belonging to the same parent branch [0..100%] [UL/L]. It has a Lock button.

Link to internode length, when checked, links the maximum leaf length to its parent culm internode length [UC/C]. This means that the branches springing from this culm that have shorter internodes will produce proportionally shorter leaves.

Link to internode length **to minimum** parameter sets the minimum leaf length allowed if “link to internode length” is checked [10...VARmm].

Link to parent length, when checked, links the maximum leaf length to the longest branch in the parent cluster [UC/C]. This means that the branches in this cluster that are shorter will produce proportionally shorter leaves.

Link to parent length **to minimum** parameter sets the the minimum leaf length allowed if “link to parent length” is checked [10...VARmm].



- 000 -

Leaf **Width** parameter sets the maximum width for leaves [5... 100mm].

- 000 -

Leaf **Petiole Length** parameter sets the length of leaf petiole [1...10mm].

- 000 -

Leaf **Petiole Width** parameter sets the width of leaf petiole [1...10mm].

- 000 -

Leaf **ILeaf (interleaf) Length** parameter sets the interleaf length [1...100mm]. When double clicked it brings up Interleaf Length window with parameters related to interleaf and leaf sheath lengths.

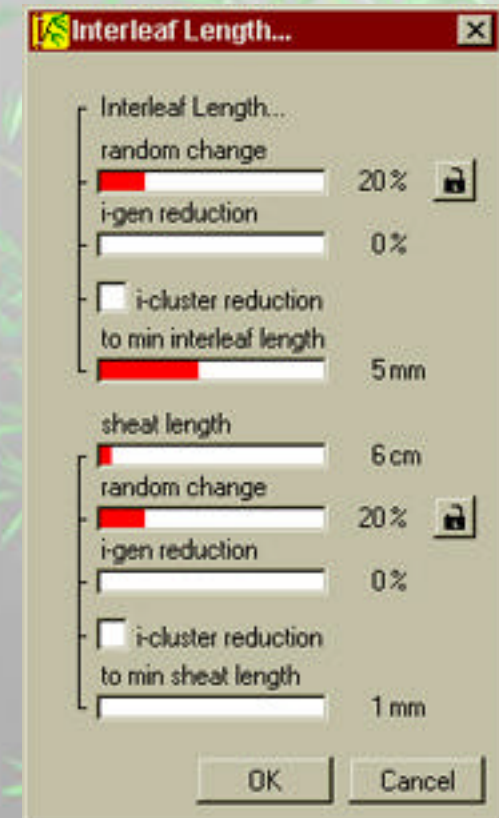
The first group of parameters is related to interleaf lengths. The **Interleaf Length** group includes the following parameters:

Random change parameter sets the extent of variations of interleaf lengths [0...100%] [UL/L]. It has a Lock button.

I-gen(inter-generation) reduction parameter sets the reduction for interleaf lengths on subsequent generations of branches [0...100%].

I-cluster (inter-cluster) reduction, when checked, links the maximum interleaf length to the longest branch in the parent cluster [UC/C]. This means that the branches in this cluster that are shorter will have proportionally shorter interleaf lengths.

To min. (minimum) interleaf length parameter sets the minimum internode length allowed if “i-gen reduction” is greater than zero or “i-cluster



reduction” is checked [1...VARmm].

The second group of parameters is related to leaf sheaths. This group includes the following parameters:

Sheath length parameter sets the length of leaf sheaths [1...100cm].

Random change parameter sets the extent of variations of leaf sheath lengths [0...100%] [UL/L]. It has a Lock button.

I-gen(inter-generation) reduction parameter sets the reduction for leaf sheath lengths on subsequent generations of branches [0...100%].

I-cluster (inter-cluster) reduction, when checked, links the maximum leaf sheath length to the longest branch in the parent cluster [UC/C]. This means that the branches in this cluster that are shorter will have proportionally shorter leaf sheaths.

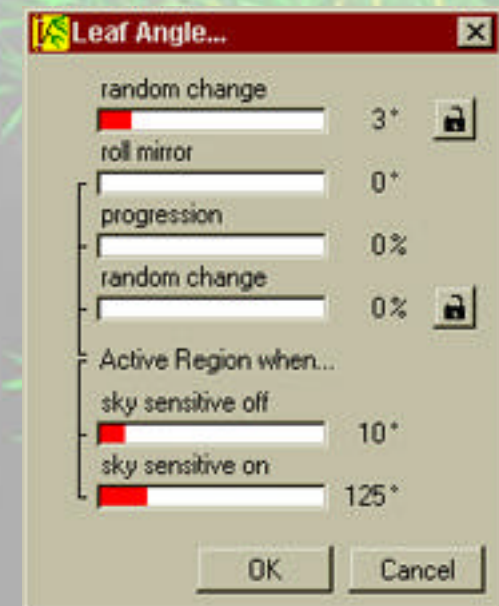
To minimum sheath length parameter sets the minimum sheath length allowed if “i-gen reduction” is greater than zero or “i-cluster reduction” is checked [1...VARmm].

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Leaf **Angle** parameter sets the maximum leaf angle with reference to its parent branch axis [5...140deg]. When double clicked it brings up Leaf Angle window with additional leaf angle parameters.

Random change parameter sets the extent of variations of leaf angle [0...20deg] [UL/L]. It has a Lock button.

Roll mirror parameter sets the leaf roll mirror angle [0...90deg]. The leaf



roll mirror angle is measured with reference to the leaf's parent branch axis the same way as the angle set by the leaf "Angle" parameter.

Roll mirror **progression** parameter reduces the roll angle progressively towards the top of the parent branch [0...100%].

Roll mirror **random change** parameter sets the extent of variations in roll mirror angles and their active regions [0...100%] [UL/L]. It has a Lock button.

Active Region when sky sensitive off sets the angle of parent branch towards the sky at which the leaves start rolling [0...90deg]. This parameter is active only when the "sky sensitive" parameter in the Leaf Twist dialog is unchecked.

Active Region when sky sensitive on sets the angle of parent branch towards the sky at which the leaves start rolling [110...180deg]. This parameter is active only when the "sky sensitive" parameter in the Leaf Twist dialog is checked.

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Leaf **Twist** parameter sets the leaf twist angle around the parent branch [0...360deg]. When double clicked it brings up Leaf Twist window with additional leaf twist parameters.

Random change parameter sets the extent of variations of leaf twist [0...90deg] [UL/L]. It has a Lock button.

Sky Sensitive for single leaves forces single leaves to orient their faces towards the sky [UC/C].



Sky Sensitive for leaf groups forces leaf groups of the same parent branch to orient themselves outwards, towards the sky [UC/C].

Random roll for single leaves parameter sets the extent of variations in roll twist that rotates an individual leaf around its own axis [0...90deg] [UL/L]. It has a Lock button.

Random leaf roll for leaf groups parameter sets the extent of variations in roll twist that rotates a leaf group belonging to the same parent branch around its own axis [0...90deg] [UL/L]. It has a Lock button.

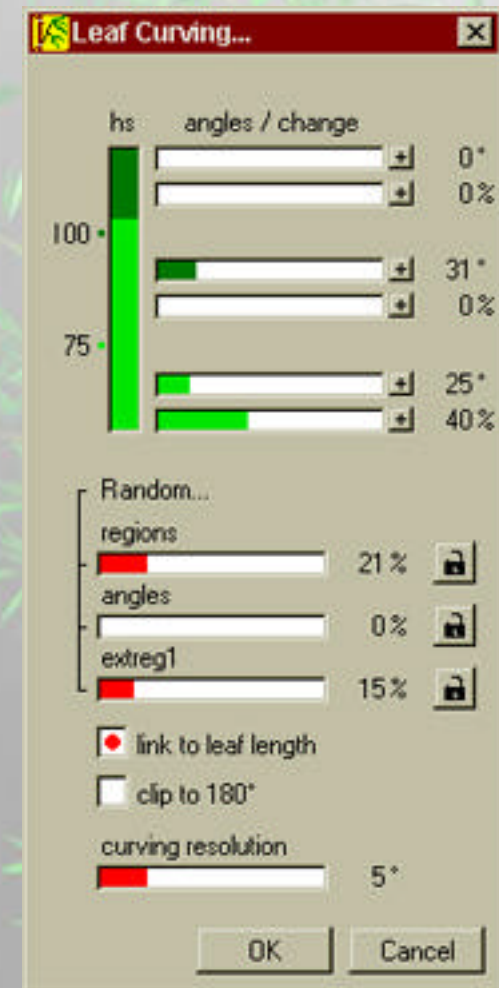
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Leaf **Curving** button brings up Leaf Curving window with the parameters related to leaf curvatures.

Heights - hs - parameter is a vertical bar with two sliders [0...100] [0...100]. Their values are shown on the left side of the bar. A value of one hundred corresponds to the full leaf length. Those two sliders set three curving regions of the leaf which can be curved independently. The three regions are designated with three different colors: light green, dark green, and crimson.

Angles/change parameters are actually three pairs of sliders located to the right of the vertical "hs" bar.

Angles parameters are the upper sliders of the three pairs [LG/DG/CR] [0...180deg] [+/-]. These sliders are designated with three different colors (light green, dark green, and crimson) and they control the curvatures of the corresponding curving regions. Example: if both hs sliders are set to 100, then there is only one region - LG - light green. Upper two horizon-



tal sliders have no effect on this region. The bottom slider is the one that controls the curvature of the given region. +/- buttons to the right of these sliders set the direction of curving for the corresponding curving regions.

Change parameters are the lower sliders of the three pairs [LG/DG/CR] [0...100%] [+/-]. These sliders change the curving angles set by the corresponding “angles” sliders. +/- buttons to the right of these sliders set the direction of change for the corresponding curving regions.

Random regions parameter varies “hs” regions of curvature [0...100%] [UL/L]. It has a Lock button.

Random angles parameter varies curving angles set by the “angles” sliders [0...100%] [UL/L]. It has a Lock button.

Random extreg1 parameter extends the first curving region randomly [0...100%] [UL/L]. It has a Lock button.

Link to leaf length parameter check box, when checked, links the curving regions to the length as set by the leaf “Length” parameter. This means that the curving regions will be mapped to this leaf length. As a result, the shorter leaves will curve proportionally less than the longer ones. If unchecked, the curving regions will be linked to the length of the current leaf. Hence, all first the leaves, be they short or long, will curve in similar fashion.

Clip to 180deg parameter check box, when checked, enforces all the leaves not to curve pass 180 degrees which has the effect of gravitational force on all the leaves curving downward [UC/C].

Curving resolution parameter sets the minimum bending angle at which



additional leaf segmentation must occur to preserve the specified curving resolution [1...20deg]. The higher the value the less segments will be needed resulting in the smaller number of polygons.

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Leaf **Color** parameter button brings up Leaf Color window. Here you can set the color of the leaves as well as its contrasts.

Random change parameter randomizes the RGB values of colors between starting (displayed in the left box) and ending color (displayed in the right box) [0...100%] [UL/L]. It has a Lock button.

Leaf palette shows the colors on the leaves if any of the two contrast are checked. Two boxes to the left and to the right of the palette show starting and ending colors and are mouse activated. When any of the two is selected, it brings up standard Windows color picker, where you can select a desired color. The palette will display the colors in between the two colors shown in the left and right boxes. If longitudinal and transversal contrasts are not active, the leaves assume the starting color (shown in the left box), otherwise they assume the range of colors shown in the palette.

Long. (longitudinal) contrast checkbox enables longitudinal contrast [UC/C]. Longitudinal contrast applies the leaf palette colors from the bottom to the top of the leaf.

Long. contrast **starts at** parameter defines the height of the leaf at which the color starts to change [0...100%]. If it is fifty, for example, then the bottom half of the leaf will have the starting color (shown in the box to the left of the leaf palette) and the colors of the top half of the leaf will



gradually change from the starting color to the ending color (shown in the box to the right of the leaf palette).

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Leaf **Growth** button brings up Leaf Growth parameter window with parameters related to leaf growth.

Random change parameter sets the extent of variations in leaf growth [0...100%][UL/L]. It has a Lock button.

Leaf activation parameter sets the dormancy time of the successor leaf [0...100%].

Elongation speed parameter sets the speed of leaf elongation [1...100mm/d (day)].

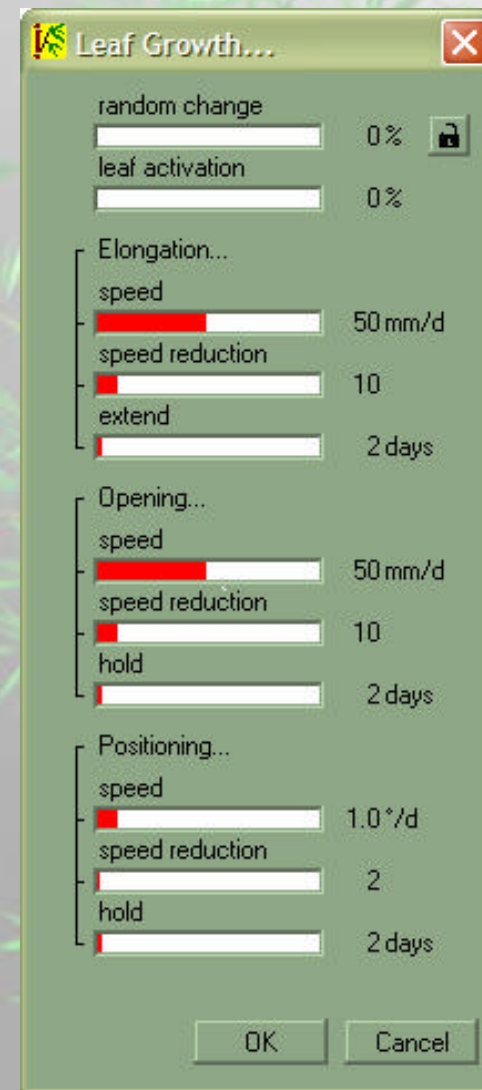
Elongation speed reduction parameter sets the leaf elongation speed reduction factor [1...100].

Elongation extend parameter extends the time of leaf elongation [0...100days].

Opening speed parameter sets the speed of leaf opening [1...100mm/d (day)].

Opening speed reduction parameter sets the leaf opening speed reduction factor [1...100].

Opening hold parameter sets the hold time before the leaf starts to open [0...100days].



Positioning speed parameter sets the speed it takes a leaf to move to its terminal position [0.1...10deg/d (day)].

Positioning speed reduction parameter sets the leaf positioning speed reduction factor [1...100].

Positioning hold parameter sets the hold time before the leaf starts to move to its terminal position [0...100days].



3D Model Export

OnyxTREE BAMBOO is capable to export a single 3D model or a sequence of 3D models in 3DS, C4D, DXF, FACT, LWO, and OBJ file formats.

Bamboo 3D model has structural layers. Once a bamboo is imported into a 3D application these layers may be represented in different ways. Other names for layer equivalents may be mesh, sub-object, sub-material, etc.

Bamboo 3D model has up to 16 layers, their respective names are:

Culm1 carries the culm sub-object 1

Culm2 carries the culm sub-object 2 (when selected)

Culm3 carries the culm sub-object 3 (when selected)

Culm4 carries the culm sub-object 4 (when selected)

Culm5 carries the culm sub-object 5 (when selected)

Culm Nodes carries all culm nodes

Branch1 carries the first generation branches

Branch1 Nodes carries all the nodes of the first generation branches

Branch2+ carries branches of all subsequent generations

Branch2+ Nodes carries the nodes of all subsequent generations

Petiole carries leaf petioles

Leaf1 carries the leaf sub-object 1

Leaf2 carries the leaf sub-object 2 (when selected)

Leaf3 carries the leaf sub-object 3 (when selected)

Leaf4 carries the leaf sub-object 4 (when selected)

Leaf5 carries the leaf sub-object 5 (when selected)

3DS File Export

3DS is the Autodesk 3D Studio binary file format widely used for transferring 3D data among CAD and other 3D graphic applications including rendering and animation programs. The BAMBOO's 3DS files carry full 3D geometry, the color per material information and the UV information for these materials.

Once you have the correct parameter settings for a particular bamboo, you can interrupt the preview rendering anytime and proceed with saving the bamboo as a 3DS file, or you can skip the rendering all together and proceed directly with the saving.

To save a 3D bamboo model, go under File menu and select Save Model as 3DS. The window appears. It contains two sections: Detail and Resolution section and Single instance/Growth sequence section.



Detail and Resolution - Each class of bamboo elements can be modeled or it can be excluded from the model all together. For example, if you check **C** (complex) for the culm, the culm will be modeled as a sequence of cylindrical segments of the chosen transversal and curving

resolutions. If you check **N** (node), the nodes of the corresponding bamboo element will be modeled. If you check **BN** (break node), BAMBOO will segment (break) the corresponding bamboo element at its nodes. Only when the element is segmented at nodes, the nodes can be modeled, i.e. when “BN” is not checked, “N” is unchecked and dimmed. The nodes are important for close-ups, but for average camera movements, you can get away without modeling them to save some polygons.

When you select any of the modeling options for any class of bamboo elements, you get an instant feedback on the number of polygons for this particular layer (**Polygons** column) and its fraction relative to the overall size of the file (**Fraction** column). Thus you see not only the size of this layer in terms of absolute polygon numbers, but also its impact on the overall size of the file. And this information will help you to choose the most effective strategy in lowering the number of polygons for a particular bamboo.

By pressing **Minimize** button, all the relevant export parameters will be adjusted automatically to give you the smallest number of polygons for a given bamboo. That is, culms will be modeled with transversal resolution 5 and curving resolution of 5 or larger. No nodes will be modeled anywhere. Branch1 will be modeled with transversal resolution 3 and curving resolution 10 or higher. Branch2+ and Petiole will not be modeled at all. The leaves (Leaf layers) will be modeled as simple.

Count button commands BAMBOO to count the polygons for a particular bamboo model and display its overall polygon number size.

Transversal Resolution defines for each cylindrical segment of a particular class of bamboo elements the number of polygons it is composed



of. You can adjust the transversal resolution of each class of bamboo elements independently [3...32sides]. The transversal resolution may be adjusted to fit the the fidelity requirements for a particular bamboo model.

Curving Resolution sets the number of segments (longitudinal resolution) for a particular class of bamboo elements [1...20deg]. Measured in degrees, it defines the maximum allowable angle between two neighboring segments. Smaller angle means higher curving resolution and will result in smoother curvatures and more polygons. You can adjust the curving resolution of each class of bamboo elements independently (blue sliders).

UV column. Please notice that all UV check boxes are checked and grayed-out. This means that all polygons carry UV mapping coordinates.

S column. There is a check box in S column and Leaf row. When checked, all bamboo leaves are modeled as simple two polygon leaves.

Sub-objects column contains two independent sliders, one for the culm and the other for leaves [1...5] [1...5]. When set to 1, the culm is saved as one sub-object. When set to 5, there are five sub-objects used for each culm, that is, the culm's internodes will be saved as separate entities in five different sub-objects. This feature is useful if you want to texture map the culm's internodes with more than one texture. The same goes for the leaves.

Units button brings up the scene units floating menu which allows you to choose the units in which the bamboo will be exported out [mm, cm, m, km, inch, feet, yard, mile].




Single instance tab presents you with the choice to save a bamboo at certain age. There, you can select **End state** check box or **At age** check box. If you check **End state**, a fully grown bamboo will be saved. The age of this bamboo is shown on the right in Y/M/D/h/m (Year/Month/Day/hour/minute) uneditable age fields. If you check **At age**, you can save a bamboo at a desired age. Enter the age numbers in Y/M/D/h/m editable fields on the right.

Growth sequence presents you with the choice to save a bamboo as it grows over time as a sequence of 3DS files. These files are named with the following convention: first frame is named 0000Name.3ds, the next is 0001Name.3ds, etc. You can select **Complete** check box or **From age** check box. If you check **Complete**, a complete bamboo growth will be saved. The time span of this bamboo (from its birth to its end-state) is shown in Y/M/D/h/m uneditable age fields on the right. If you check **From age**, you can save a partial bamboo growth sequence. In order to do that, you need to specify the beginning and ending age in Y/M/D/h/m editable fields on the right. The complete or partial growth sequence is saved as a sequence of numbered 3D



models (or frames). You can specify the number of models (frames) by selecting **30 frames** check box, **300 frames** check box or **Custom** check box. If you select **Custom** option, you have to specify the number of models (frames) by entering its value in the text box to the right of the check box [1...9999].

If you are exporting growth sequence, **Export status** window comes up when you press **Save** button. In order to initiate the saving process, you need to press another **Save** button, this one is in Export Status window. Once the saving has begun, the Export status will show you the progress. You can cancel the saving at any time by pressing **Cancel**.

A screenshot of the 'Export Status' dialog box. It has a title bar with the text 'Export Status' in white on a dark red background. The main area is light gray and contains three input fields with labels to their right: '1 First frame', '90 Last frame', and '0 Current frame'. Each input field is a simple rectangular box. At the bottom right of the dialog is a 'Save' button with a thin black border.

Field	Value	Label
First frame	1	First frame
Last frame	90	Last frame
Current frame	0	Current frame

Save

C4D File Export

C4D is Maxon Computer Cinema 4D file format. It is used for transferring 3D data to and from Cinema 4D modeling, rendering and animation program. The BAMBOOs C4D files carry full 3D geometry, layers, color per layer information, and UV information for these layers.

Once you have the correct parameter settings for a particular bamboo, you can interrupt the preview rendering anytime and proceed with saving the bamboo as a C4D file, or you can skip the rendering all together and proceed directly with the saving.

To save a 3D bamboo model, go under File menu and select Save Model as C4D. The window appears. It contains two sections: Detail and Resolution section and Single instance/Growth sequence section.



Detail and Resolution - Each class of bamboo elements can be modeled or it can be excluded from the model all together. For example, if you check **C** (complex) for the culm, the culm will be modeled as a sequence of cylindrical segments of the chosen transversal and curving

resolutions. If you check **N** (node), the nodes of the corresponding bamboo element will be modeled. If you check **BN** (break node), BAMBOO will segment (break) the corresponding bamboo element at its nodes. Only when the element is segmented at nodes, the nodes can be modeled, i.e. when “BN” is not checked, “N” is unchecked and dimmed. The nodes are important for close-ups, but for average camera movements, you can get away without modeling them to save some polygons.

When you select any of the modeling options for any class of bamboo elements, you get an instant feedback on the number of polygons for this particular layer (**Polygons** column) and its fraction relative to the overall size of the file (**Fraction** column). Thus you see not only the size of this layer in terms of absolute polygon numbers, but also its impact on the overall size of the file. And this information will help you to choose the most effective strategy in lowering the number of polygons for a particular bamboo.

By pressing **Minimize** button, all the relevant export parameters will be adjusted automatically to give you the smallest number of polygons for a given bamboo. That is, culms will be modeled with transversal resolution 5 and curving resolution of 5 or larger. No nodes will be modeled anywhere. Branch1 will be modeled with transversal resolution 3 and curving resolution 10 or higher. Branch2+ and Petiole will not be modeled at all. The leaves (Leaf layers) will be modeled as simple.

Count button commands BAMBOO to count the polygons for a particular bamboo model and display its overall polygon number size.

Transversal Resolution defines for each cylindrical segment of a particular class of bamboo elements the number of polygons it is composed

of. You can adjust the transversal resolution of each class of bamboo elements independently [3...32sides]. The transversal resolution may be adjusted to fit the the fidelity requirements for a particular bamboo model.

Curving Resolution sets the number of segments (longitudinal resolution) for a particular class of bamboo elements [1...20deg]. Measured in degrees, it defines the maximum allowable angle between two neighboring segments. Smaller angle means higher curving resolution and will result in smoother curvatures and more polygons. You can adjust the curving resolution of each class of bamboo elements independently (blue sliders).

UV column. Please notice that all UV check boxes are checked and grayed-out. This means that all polygons carry UV mapping coordinates.

S column. There is a check box in S column and Leaf row. When checked, all bamboo leaves are modeled as simple two polygon leaves.

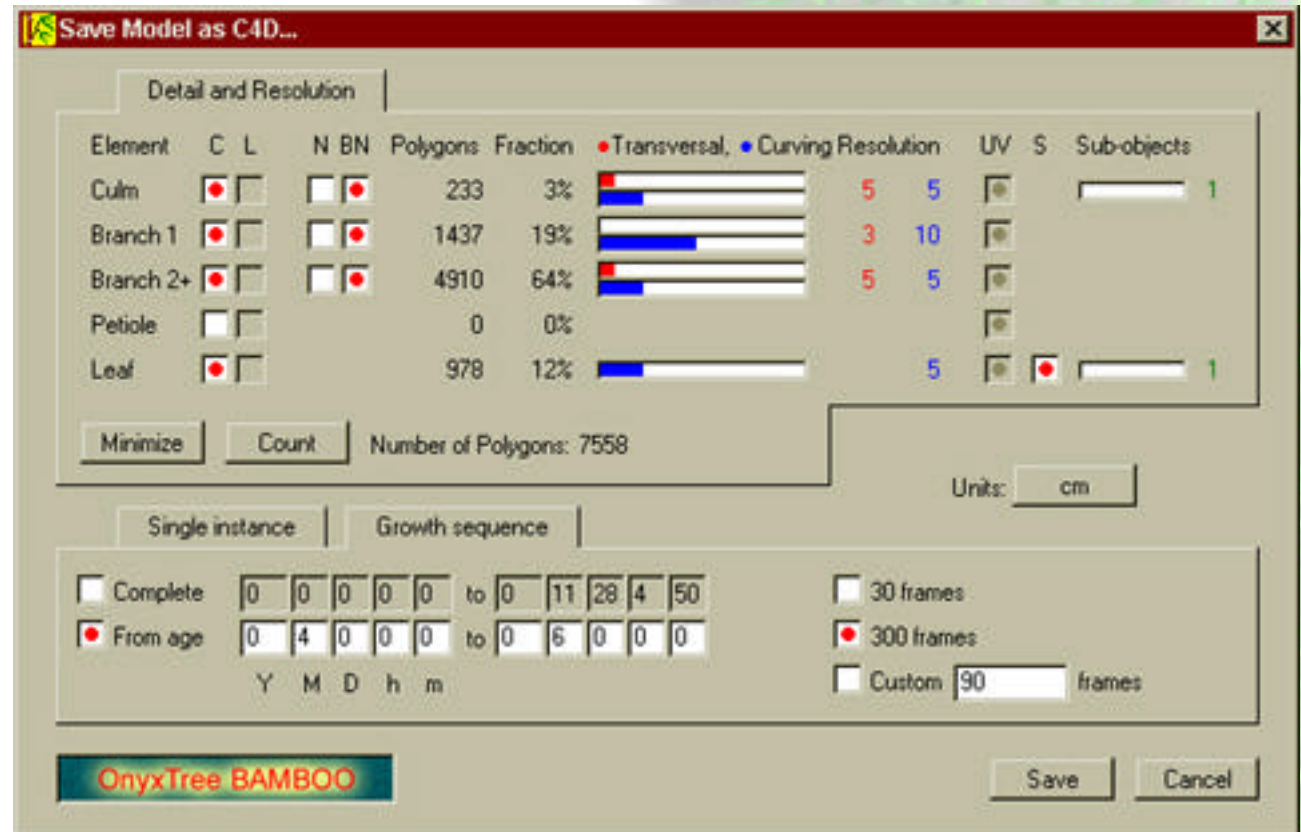
Sub-objects column contains two independent sliders, one for the culm and the other for leaves [1...5] [1...5]. When set to 1, the culm is saved as one sub-object. When set to 5, there are five sub-objects used for each culm, that is, the culm's internodes will be saved as separate entities in five different sub-objects. This feature is useful if you want to texture map the culm's internodes with more than one texture. The same goes for the leaves.

Units button brings up the scene units floating menu which allows you to choose the units in which the bamboo will be exported out [mm, cm, m, km, inch, feet, yard, mile].



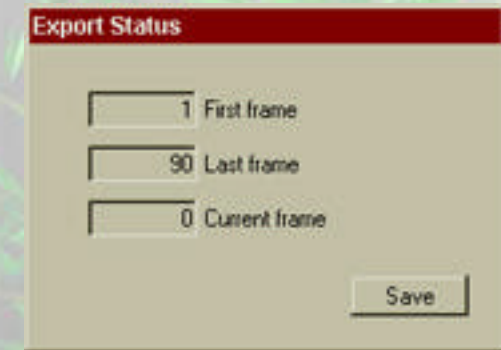
Single instance tab presents you with the choice to save a bamboo at certain age. There, you can select **End state** check box or **At age** check box. If you check **End state**, a fully grown bamboo will be saved. The age of this bamboo is shown on the right in Y/M/D/h/m (Year/Month/Day/hour/minute) uneditable age fields. If you check **At age**, you can save a bamboo at a desired age. Enter the age numbers in Y/M/D/h/m editable fields on the right.

Growth sequence presents you with the choice to save a bamboo as it grows over time as a sequence of 3DS files. These files are named with the following convention: first frame is named 0000Name.3ds, the next is 0001Name.3ds, etc. You can select **Complete** check box or **From age** check box. If you check **Complete**, a complete bamboo growth will be saved. The time span of this bamboo (from its birth to its end-state) is shown in Y/M/D/h/m uneditable age fields on the right. If you check **From age**, you can save a partial bamboo growth sequence. In order to do that, you need to specify the beginning and ending age in Y/M/D/h/m editable fields on the right. The complete or partial growth sequence is saved as a sequence of numbered 3D



models (or frames). You can specify the number of models (frames) by selecting **30 frames** check box, **300 frames** check box or **Custom** check box. If you select **Custom** option, you have to specify the number of models (frames) by entering its value in the text box to the right of the check box [1...9999].

If you are exporting growth sequence, **Export status** window comes up when you press **Save** button. In order to initiate the saving process, you need to press another **Save** button, this one is in Export Status window. Once the saving has begun, the Export status will show you the progress. You can cancel the saving at any time by pressing **Cancel**.

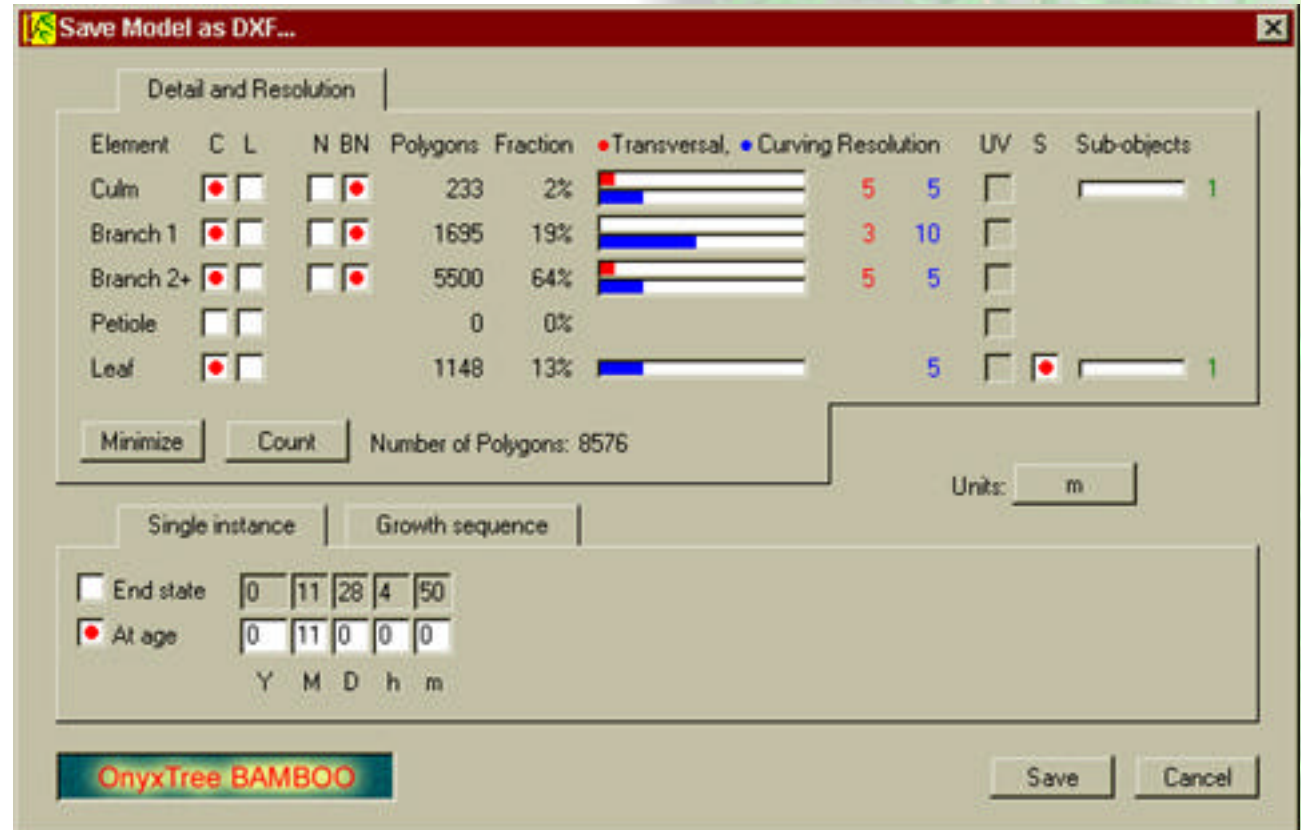


DXF File Export

DXF or Drawing Interchange File is a standard ASCII text file format widely used for transferring 3D data among CAD and other 3D graphic applications including rendering and animation programs. The TREE's DXF files carry full 3D geometry and color information on up to sixteen (16) structural layers.

Once you have the correct parameter settings for a particular bamboo, you can interrupt the preview rendering anytime and proceed with saving the bamboo as a 3DS file, or you can skip the rendering all together and proceed directly with the saving.

To save a 3D bamboo model, go under File menu and select Save Model as 3DS. The window appears. It contains two sections: Detail and Resolution section and Single instance/Growth sequence section.



Detail and Resolution - Each class of bamboo elements can be modeled or it can be excluded from the model all together. For example, if you check **C** (complex) for the culm, the culm will be modeled as a sequence of cylindrical segments of the chosen transversal and curving

resolutions. If you check **N** (node), the nodes of the corresponding bamboo element will be modeled. If you check **BN** (break node), BAMBOO will segment (break) the corresponding bamboo element at its nodes. Only when the element is segmented at nodes, the nodes can be modeled, i.e. when “BN” is not checked, “N” is unchecked and dimmed. The nodes are important for close-ups, but for average camera movements, you can get away without modeling them to save some polygons.

When you select any of the modeling options for any class of bamboo elements, you get an instant feedback on the number of polygons for this particular layer (**Polygons** column) and its fraction relative to the overall size of the file (**Fraction** column). Thus you see not only the size of this layer in terms of absolute polygon numbers, but also its impact on the overall size of the file. And this information will help you to choose the most effective strategy in lowering the number of polygons for a particular bamboo.

By pressing **Minimize** button, all the relevant export parameters will be adjusted automatically to give you the smallest number of polygons for a given bamboo. That is, culms will be modeled with transversal resolution 5 and curving resolution of 5 or larger. No nodes will be modeled anywhere. Branch1 will be modeled with transversal resolution 3 and curving resolution 10 or higher. Branch2+ and Petiole will not be modeled at all. The leaves (Leaf layers) will be modeled as simple.

Count button commands BAMBOO to count the polygons for a particular bamboo model and display its overall polygon number size.

Transversal Resolution defines for each cylindrical segment of a particular class of bamboo elements the number of polygons it is composed

of. You can adjust the transversal resolution of each class of bamboo elements independently [3...32sides]. The transversal resolution may be adjusted to fit the fidelity requirements for a particular bamboo model.

Curving Resolution sets the number of segments (longitudinal resolution) for a particular class of bamboo elements [1...20deg]. Measured in degrees, it defines the maximum allowable angle between two neighboring segments. Smaller angle means higher curving resolution and will result in smoother curvatures and more polygons. You can adjust the curving resolution of each class of bamboo elements independently (blue sliders).

UV column. Please notice that all UV check boxes are unchecked and grayed-out. DXF file format does not support UV mapping coordinates.

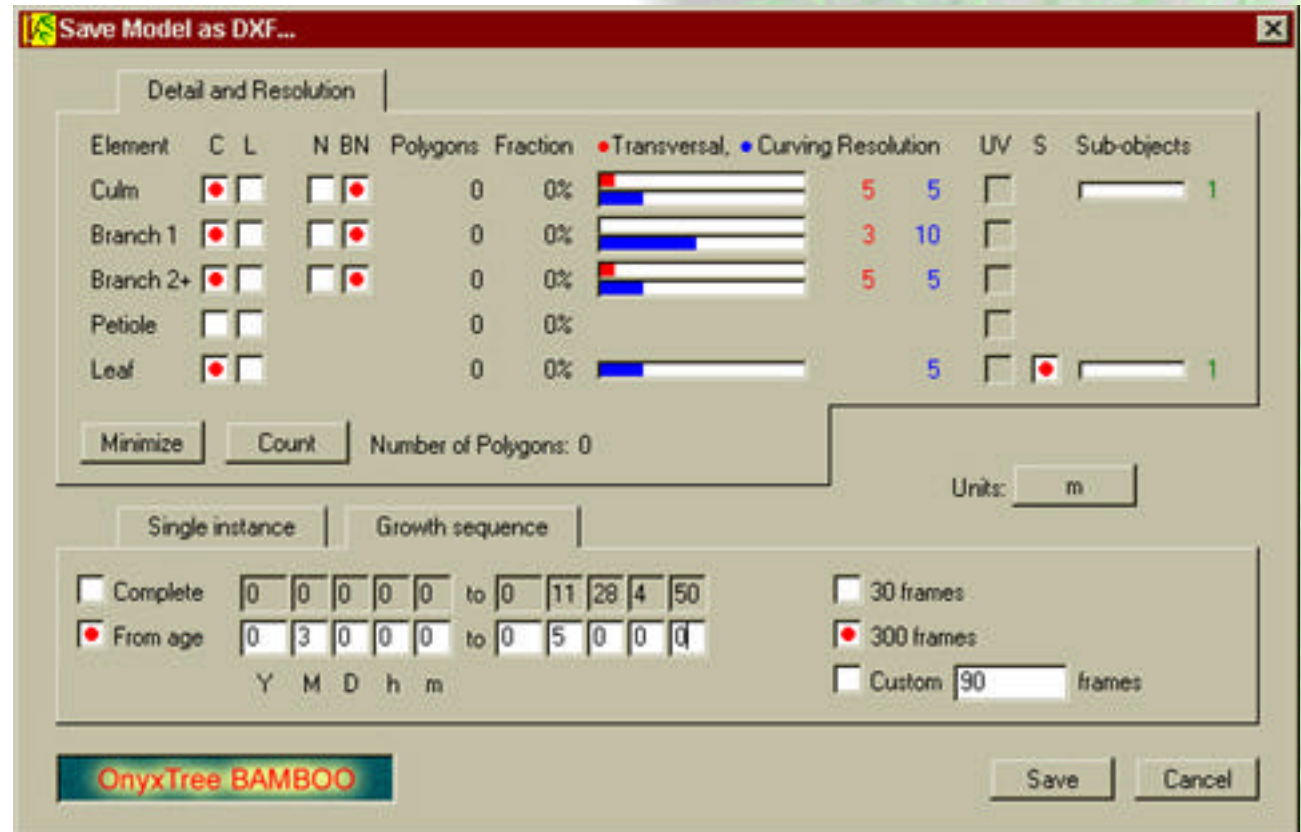
S column. There is a check box in S column and Leaf row. When checked, all bamboo leaves are modeled as simple two polygon leaves.

Sub-objects column contains two independent sliders, one for the culm and the other for leaves [1...5] [1...5]. When set to 1, the culm is saved as one sub-object. When set to 5, there are five sub-objects used for each culm, that is, the culm's internodes will be saved as separate entities in five different sub-objects. This feature is useful if you want to texture map the culm's internodes with more than one texture. The same goes for the leaves.

Units button brings up the scene units floating menu which allows you to choose the units in which the bamboo will be exported out [mm, cm, m, km, inch, feet, yard, mile].

Single instance tab presents you with the choice to save a bamboo at certain age. There, you can select **End state** check box or **At age** check box. If you check **End state**, a fully grown bamboo will be saved. The age of this bamboo is shown on the right in Y/M/D/h/m (Year/Month/Day/hour/minute) uneditable age fields. If you check **At age**, you can save a bamboo at a desired age. Enter the age numbers in Y/M/D/h/m editable fields on the right.

Growth sequence presents you with the choice to save a bamboo as it grows over time as a sequence of 3DS files. These files are named with the following convention: first frame is named 0000Name.3ds, the next is 0001Name.3ds, etc. You can select **Complete** check box or **From age** check box. If you check **Complete**, a complete bamboo growth will be saved. The time span of this bamboo (from its birth to its end-state) is shown in Y/M/D/h/m uneditable age fields on the right. If you check **From age**, you can save a partial bamboo growth sequence. In order to do that, you need to specify the beginning and ending age in Y/M/D/h/m editable fields on the right. The complete or partial growth sequence is saved as a sequence of numbered 3D



models (or frames). You can specify the number of models (frames) by selecting **30 frames** check box, **300 frames** check box or **Custom** check box. If you select **Custom** option, you have to specify the number of models (frames) by entering its value in the text box to the right of the check box [1...9999].

If you are exporting growth sequence, **Export status** window comes up when you press **Save** button. In order to initiate the saving process, you need to press another **Save** button, this one is in Export Status window. Once the saving has begun, the Export status will show you the progress. You can cancel the saving at any time by pressing **Cancel**.

A screenshot of a software dialog box titled "Export Status". The dialog has a light beige background and a dark red title bar. It contains three input fields, each with a label to its right: the first field contains "1" and is labeled "First frame"; the second field contains "90" and is labeled "Last frame"; the third field contains "0" and is labeled "Current frame". At the bottom right of the dialog is a button labeled "Save".

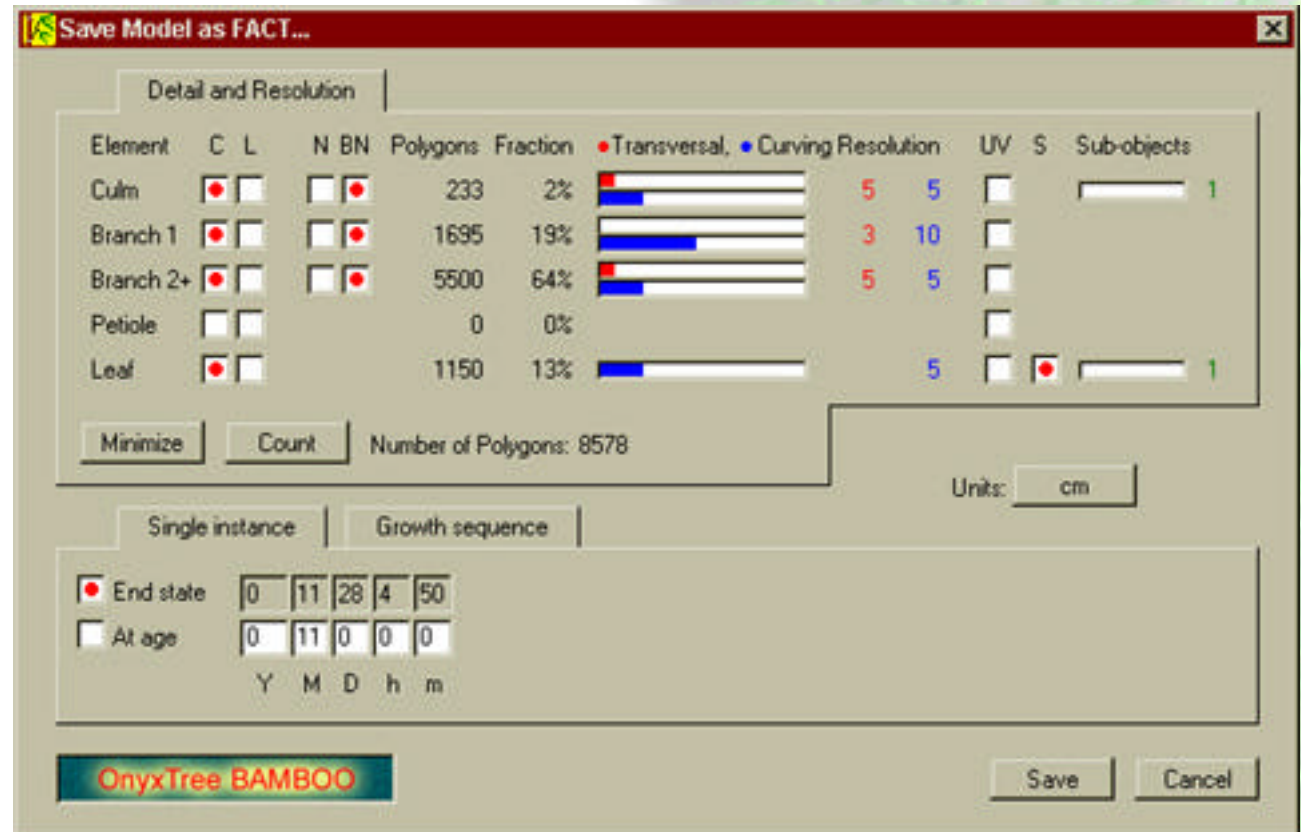
Field	Value	Label
First frame	1	First frame
Last frame	90	Last frame
Current frame	0	Current frame

FACT File Export

FAC or FACT is a 3D file format specified by ElectricImage. It is used for transferring 3D data to and from ElectricImage modeling, rendering and animation program. The TREE's FACT files carry full 3D geometry, layers, color per vertex information, and UV information for these layers.

Once you have the correct parameter settings for a particular bamboo, you can interrupt the preview rendering anytime and proceed with saving the bamboo as a 3DS file, or you can skip the rendering all together and proceed directly with the saving.

To save a 3D bamboo model, go under File menu and select Save Model as 3DS. The window appears. It contains two sections: Detail and Resolution section and Single instance/Growth sequence section.



Detail and Resolution - Each class of bamboo elements can be modeled or it can be excluded from the model all together. For example, if you check **C** (complex) for the culm, the culm will be modeled as a sequence of cylindrical segments of the chosen transversal and curving

resolutions. If you check **N** (node), the nodes of the corresponding bamboo element will be modeled. If you check **BN** (break node), BAMBOO will segment (break) the corresponding bamboo element at its nodes. Only when the element is segmented at nodes, the nodes can be modeled, i.e. when “BN” is not checked, “N” is unchecked and dimmed. The nodes are important for close-ups, but for average camera movements, you can get away without modeling them to save some polygons.

When you select any of the modeling options for any class of bamboo elements, you get an instant feedback on the number of polygons for this particular layer (**Polygons** column) and its fraction relative to the overall size of the file (**Fraction** column). Thus you see not only the size of this layer in terms of absolute polygon numbers, but also its impact on the overall size of the file. And this information will help you to choose the most effective strategy in lowering the number of polygons for a particular bamboo.

By pressing **Minimize** button, all the relevant export parameters will be adjusted automatically to give you the smallest number of polygons for a given bamboo. That is, culms will be modeled with transversal resolution 5 and curving resolution of 5 or larger. No nodes will be modeled anywhere. Branch1 will be modeled with transversal resolution 3 and curving resolution 10 or higher. Branch2+ and Petiole will not be modeled at all. The leaves (Leaf layers) will be modeled as simple.

Count button commands BAMBOO to count the polygons for a particular bamboo model and display its overall polygon number size.

Transversal Resolution defines for each cylindrical segment of a particular class of bamboo elements the number of polygons it is composed

of. You can adjust the transversal resolution of each class of bamboo elements independently [3...32sides]. The transversal resolution may be adjusted to fit the fidelity requirements for a particular bamboo model.

Curving Resolution sets the number of segments (longitudinal resolution) for a particular class of bamboo elements [1...20deg]. Measured in degrees, it defines the maximum allowable angle between two neighboring segments. Smaller angle means higher curving resolution and will result in smoother curvatures and more polygons. You can adjust the curving resolution of each class of bamboo elements independently (blue sliders).

UV column. You have a choice of exporting any class of bamboo elements with color-per-vertex coordinates or with UV mapping coordinates. Check this check box if you wish to export corresponding class of bamboo elements with UV coordinates.

S column. There is a check box in S column and Leaf row. When checked, all bamboo leaves are modeled as simple two polygon leaves.

Sub-objects column contains two independent sliders, one for the culm and the other for leaves [1...5] [1...5]. When set to 1, the culm is saved as one sub-object. When set to 5, there are five sub-objects used for each culm, that is, the culm's internodes will be saved as separate entities in five different sub-objects. This feature is useful if you want to texture map the culm's internodes with more than one texture. The same goes for the leaves.

Units button brings up the scene units floating menu which allows you to choose the units in which the bamboo will be exported out [mm, cm, m,

Single instance tab presents you with the choice to save a bamboo at certain age. There, you can select **End state** check box or **At age** check box. If you check **End state**, a fully grown bamboo will be saved. The age of this bamboo is shown on the right in Y/M/D/h/m (Year/Month/Day/hour/minute) uneditable age fields. If you check **At age**, you can save a bamboo at a desired age. Enter the age numbers in Y/M/D/h/m editable fields on the right.

Save Model as FACT...

Detail and Resolution

Element	C	L	N	BN	Polygons	Fraction	Transversal, Curving Resolution	UV	S	Sub-objects	
Culm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	233	2%		5	5	<input type="checkbox"/>	<input type="text" value="1"/>
Branch 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1695	19%		3	10	<input type="checkbox"/>	
Branch 2+	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	5500	64%		5	5	<input type="checkbox"/>	
Petiole	<input type="checkbox"/>	<input type="checkbox"/>			0	0%				<input type="checkbox"/>	
Leaf	<input checked="" type="checkbox"/>	<input type="checkbox"/>			1150	13%		5		<input checked="" type="checkbox"/>	<input type="text" value="1"/>

Minimize Count Number of Polygons: 8578

Units:

Single instance **Growth sequence**

☒ Complete to

☐ From age to

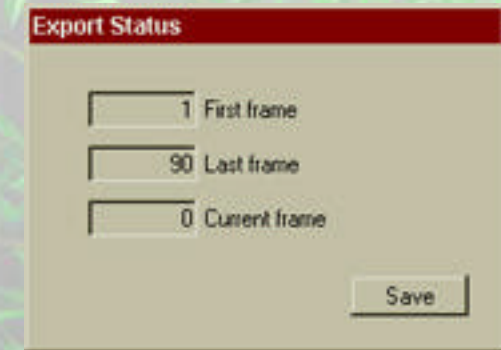
Y M D h m

☐ 30 frames ☒ 300 frames ☐ Custom frames

OnyxTree BAMBOO Save Cancel

Y/M/D/h/m editable fields on the right. The complete or partial growth sequence is saved as a sequence of numbered 3D models (or frames). You can specify the number of models (frames) by selecting **30 frames** check box, **300 frames** check box or **Custom** check box. If you select **Custom** option, you have to specify the number of models (frames) by entering its value in the text box to the right of the check box [1...9999].

If you are exporting growth sequence, **Export status** window comes up when you press **Save** button. In order to initiate the saving process, you need to press another **Save** button, this one is in Export Status window. Once the saving has begun, the Export status will show you the progress. You can cancel the saving at any time by pressing **Cancel**.



LWO File Export

LWO is the NewTek 3D file format. It is used for transferring 3D data to and from Lightwave6 or newer modeling, rendering and animation program. The TREE's LWO files carry full 3D geometry, layers, color per vertex information, and UV information for these layers.

Once you have the correct parameter settings for a particular bamboo, you can interrupt the preview rendering anytime and proceed with saving the bamboo as a 3DS file, or you can skip the rendering all together and proceed directly with the saving.

To save a 3D bamboo model, go under File menu and select Save Model as 3DS. The window appears. It contains two sections: Detail and Resolution section and Single instance/Growth sequence section.



Detail and Resolution - Each class of bamboo elements can be modeled or it can be excluded from the model all together. For example, if you check **C** (complex) for the culm, the culm will be modeled as a sequence of cylindrical segments of the chosen transversal and curving

resolutions. If you check **N** (node), the nodes of the corresponding bamboo element will be modeled. If you check **BN** (break node), BAMBOO will segment (break) the corresponding bamboo element at its nodes. Only when the element is segmented at nodes, the nodes can be modeled, i.e. when “BN” is not checked, “N” is unchecked and dimmed. The nodes are important for close-ups, but for average camera movements, you can get away without modeling them to save some polygons.

When you select any of the modeling options for any class of bamboo elements, you get an instant feedback on the number of polygons for this particular layer (**Polygons** column) and its fraction relative to the overall size of the file (**Fraction** column). Thus you see not only the size of this layer in terms of absolute polygon numbers, but also its impact on the overall size of the file. And this information will help you to choose the most effective strategy in lowering the number of polygons for a particular bamboo.

By pressing **Minimize** button, all the relevant export parameters will be adjusted automatically to give you the smallest number of polygons for a given bamboo. That is, culms will be modeled with transversal resolution 5 and curving resolution of 5 or larger. No nodes will be modeled anywhere. Branch1 will be modeled with transversal resolution 3 and curving resolution 10 or higher. Branch2+ and Petiole will not be modeled at all. The leaves (Leaf layers) will be modeled as simple.

Count button commands BAMBOO to count the polygons for a particular bamboo model and display its overall polygon number size.

Transversal Resolution defines for each cylindrical segment of a particular class of bamboo elements the number of polygons it is composed

of. You can adjust the transversal resolution of each class of bamboo elements independently [3...32sides]. The transversal resolution may be adjusted to fit the the fidelity requirements for a particular bamboo model.

Curving Resolution sets the number of segments (longitudinal resolution) for a particular class of bamboo elements [1...20deg]. Measured in degrees, it defines the maximum allowable angle between two neighboring segments. Smaller angle means higher curving resolution and will result in smoother curvatures and more polygons. You can adjust the curving resolution of each class of bamboo elements independently (blue sliders).

UV column. You have a choice of exporting any class of bamboo elements with color-per-vertex coordinates or with UV mapping coordinates. Check this check box if you wish to export corresponding class of bamboo elements with UV coordinates.

S column. There is a check box in S column and Leaf row. When checked, all bamboo leaves are modeled as simple two polygon leaves.

Sub-objects column contains two independent sliders, one for the culm and the other for leaves [1...5] [1...5]. When set to 1, the culm is saved as one sub-object. When set to 5, there are five sub-objects used for each culm, that is, the culm's internodes will be saved as separate entities in five different sub-objects. This feature is useful if you want to texture map the culm's internodes with more than one texture. The same goes for the leaves.

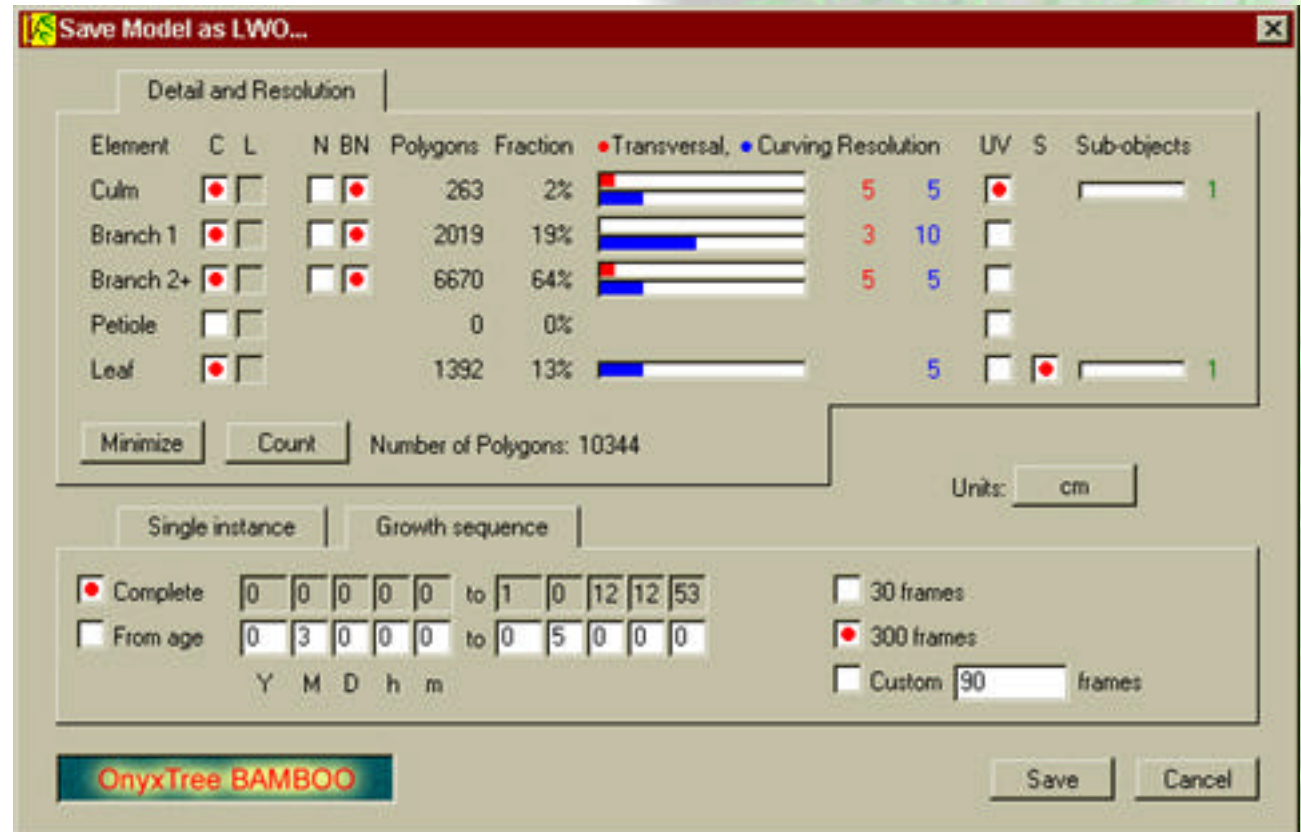
Units button brings up the scene units floating menu which allows you to choose the units in which the bamboo will be exported out [mm, cm, m,



km, inch, feet, yard, mile].

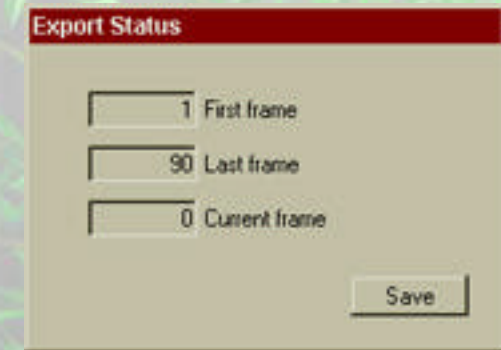
Single instance tab presents you with the choice to save a bamboo at certain age. There, you can select **End state** check box or **At age** check box. If you check **End state**, a fully grown bamboo will be saved. The age of this bamboo is shown on the right in Y/M/D/h/m (Year/Month/Day/hour/minute) uneditable age fields. If you check **At age**, you can save a bamboo at a desired age. Enter the age numbers in Y/M/D/h/m editable fields on the right.

Growth sequence presents you with the choice to save a bamboo as it grows over time as a sequence of 3DS files. These files are named with the following convention: first frame is named 0000Name.3ds, the next is 0001Name.3ds, etc. You can select **Complete** check box or **From age** check box. If you check **Complete**, a complete bamboo growth will be saved. The time span of this bamboo (from its birth to its end-state) is shown in Y/M/D/h/m uneditable age fields on the right. If you check **From age**, you can save a partial bamboo growth sequence. In order to do that, you need to specify the beginning and ending age in



Y/M/D/h/m editable fields on the right. The complete or partial growth sequence is saved as a sequence of numbered 3D models (or frames). You can specify the number of models (frames) by selecting **30 frames** check box, **300 frames** check box or **Custom** check box. If you select **Custom** option, you have to specify the number of models (frames) by entering its value in the text box to the right of the check box [1...9999].

If you are exporting growth sequence, **Export status** window comes up when you press **Save** button. In order to initiate the saving process, you need to press another **Save** button, this one is in Export Status window. Once the saving has begun, the Export status will show you the progress. You can cancel the saving at any time by pressing **Cancel**.



OBJ File Export

OBJ is the Alias|Wavefront 3D file format. It is used for transferring 3D data to Maya and to and from other modeling, rendering and animation programs. The TREE's OBJ files carry full 3D geometry, layers, color per layer information, and UV information for these layers.

Once you have the correct parameter settings for a particular bamboo, you can interrupt the preview rendering anytime and proceed with saving the bamboo as a 3DS file, or you can skip the rendering all together and proceed directly with the saving.

To save a 3D bamboo model, go under File menu and select Save Model as 3DS. The window appears. It contains two sections: Detail and Resolution section and Single instance/Growth sequence section.



Detail and Resolution - Each class of bamboo elements can be modeled or it can be excluded from the model all together. For example, if you check **C** (complex) for the culm, the culm will be modeled as a sequence of cylindrical segments of the chosen transversal and curving

resolutions. If you check **N** (node), the nodes of the corresponding bamboo element will be modeled. If you check **BN** (break node), BAMBOO will segment (break) the corresponding bamboo element at its nodes. Only when the element is segmented at nodes, the nodes can be modeled, i.e. when “BN” is not checked, “N” is unchecked and dimmed. The nodes are important for close-ups, but for average camera movements, you can get away without modeling them to save some polygons.

When you select any of the modeling options for any class of bamboo elements, you get an instant feedback on the number of polygons for this particular layer (**Polygons** column) and its fraction relative to the overall size of the file (**Fraction** column). Thus you see not only the size of this layer in terms of absolute polygon numbers, but also its impact on the overall size of the file. And this information will help you to choose the most effective strategy in lowering the number of polygons for a particular bamboo.

By pressing **Minimize** button, all the relevant export parameters will be adjusted automatically to give you the smallest number of polygons for a given bamboo. That is, culms will be modeled with transversal resolution 5 and curving resolution of 5 or larger. No nodes will be modeled anywhere. Branch1 will be modeled with transversal resolution 3 and curving resolution 10 or higher. Branch2+ and Petiole will not be modeled at all. The leaves (Leaf layers) will be modeled as simple.

Count button commands BAMBOO to count the polygons for a particular bamboo model and display its overall polygon number size.

Transversal Resolution defines for each cylindrical segment of a particular class of bamboo elements the number of polygons it is composed



of. You can adjust the transversal resolution of each class of bamboo elements independently [3...32sides]. The transversal resolution may be adjusted to fit the the fidelity requirements for a particular bamboo model.

Curving Resolution sets the number of segments (longitudinal resolution) for a particular class of bamboo elements [1...20deg]. Measured in degrees, it defines the maximum allowable angle between two neighboring segments. Smaller angle means higher curving resolution and will result in smoother curvatures and more polygons. You can adjust the curving resolution of each class of bamboo elements independently (blue sliders).

UV column. Please notice that all UV check boxes are checked and grayed-out. This means that all polygons carry UV mapping coordinates.

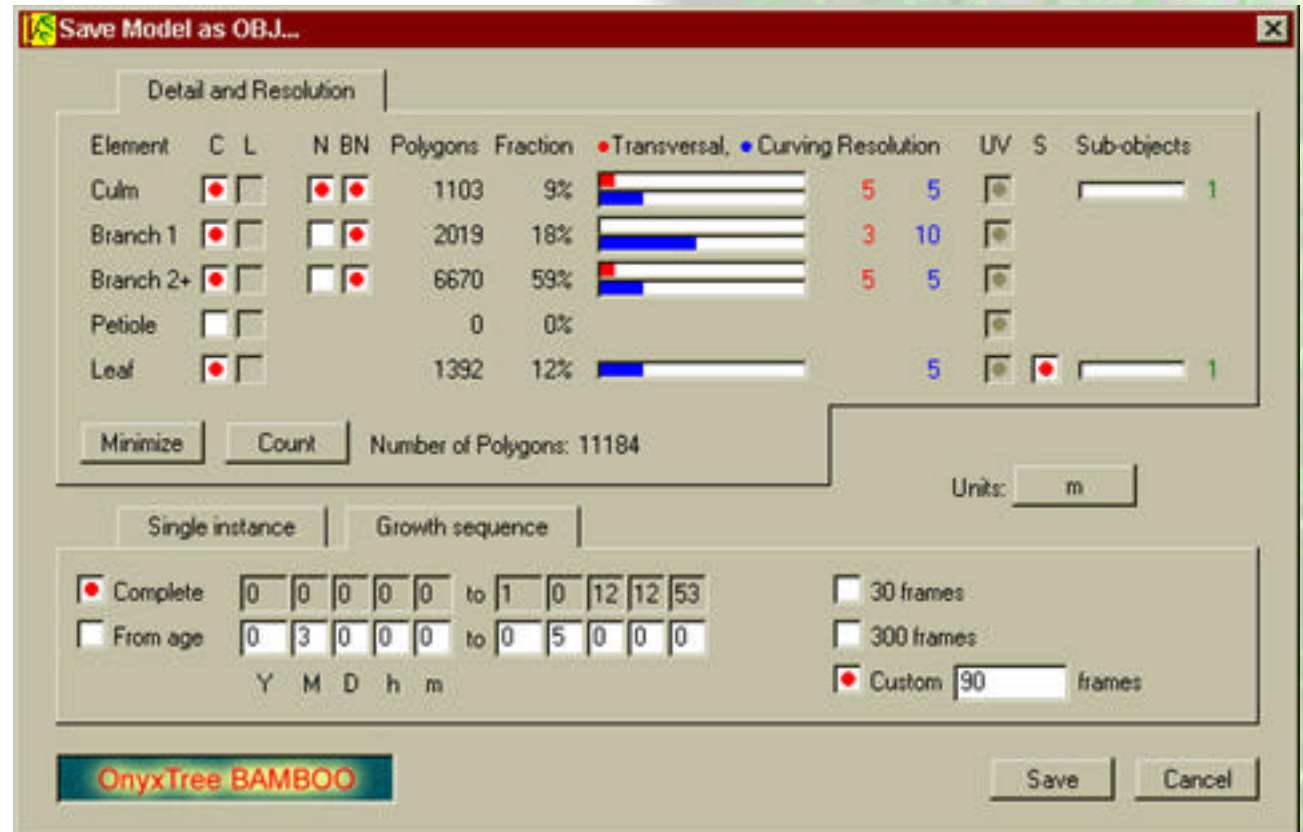
S column. There is a check box in S column and Leaf row. When checked, all bamboo leaves are modeled as simple two polygon leaves.

Sub-objects column contains two independent sliders, one for the culm and the other for leaves [1...5] [1...5]. When set to 1, the culm is saved as one sub-object. When set to 5, there are five sub-objects used for each culm, that is, the culm's internodes will be saved as separate entities in five different sub-objects. This feature is useful if you want to texture map the culm's internodes with more than one texture. The same goes for the leaves.

Units button brings up the scene units floating menu which allows you to choose the units in which the bamboo will be exported out [mm, cm, m, km, inch, feet, yard, mile].

Single instance tab presents you with the choice to save a bamboo at certain age. There, you can select **End state** check box or **At age** check box. If you check **End state**, a fully grown bamboo will be saved. The age of this bamboo is shown on the right in Y/M/D/h/m (Year/Month/Day/hour/minute) uneditable age fields. If you check **At age**, you can save a bamboo at a desired age. Enter the age numbers in Y/M/D/h/m editable fields on the right.

Growth sequence presents you with the choice to save a bamboo as it grows over time as a sequence of 3DS files. These files are named with the following convention: first frame is named 0000Name.3ds, the next is 0001Name.3ds, etc. You can select **Complete** check box or **From age** check box. If you check **Complete**, a complete bamboo growth will be saved. The time span of this bamboo (from its birth to its end-state) is shown in Y/M/D/h/m uneditable age fields on the right. If you check **From age**, you can save a partial bamboo growth sequence. In order to do that, you need to specify the beginning and ending age in Y/M/D/h/m editable fields on the right. The complete or partial growth sequence is saved as a sequence of numbered 3D



models (or frames). You can specify the number of models (frames) by selecting **30 frames** check box, **300 frames** check box or **Custom** check box. If you select **Custom** option, you have to specify the number of models (frames) by entering its value in the text box to the right of the check box [1...9999].

If you are exporting growth sequence, **Export status** window comes up when you press **Save** button. In order to initiate the saving process, you need to press another **Save** button, this one is in Export Status window. Once the saving has begun, the Export status will show you the progress. You can cancel the saving at any time by pressing **Cancel**.

A screenshot of a software dialog box titled "Export Status". The dialog has a light beige background and a dark red title bar. It contains three input fields, each with a label to its right: the first field contains "1" and is labeled "First frame"; the second field contains "90" and is labeled "Last frame"; the third field contains "0" and is labeled "Current frame". At the bottom right of the dialog is a button labeled "Save".

Field	Value	Label
First frame	1	First frame
Last frame	90	Last frame
Current frame	0	Current frame

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OnyxTREE BAMBOO 6.0

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Manual written by Dr. Bojana Bosanac and Pjer Zanchi

