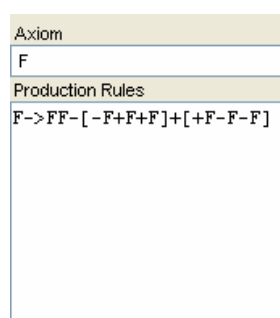# 1   <u>User Guide</u>

The L-Systems program created is handled with the use of a graphical user interface, named Lsys.jar. Jar files are executable applications written in Java and run on every computer with Java virtual machine installed. In addition to the executable, the program uses several jpeg files that can be found in the folder named textures. The application may run either from the cd-rom or from the local disk. The second option is preferable since it is faster. Attention should be made to copy the folder 'Textures' to the local disk[1] as well, if it is required to add textures and background to the image.

1.1   Input areas

To run the application, simple double-click the icon or the name of the Lsys.jar executable. The GUI opens where all input area, option buttons and operation buttons are visible. The first inputs that have to be inserted are the axiom of an L-System and its production rules. The axiom and production rules areas accept any string of bracketed systems or parametric L-systems used in tree modelling. An example is seen in Figure 1-1.

Figure 1-1 Axiom and Production Rules areas

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[1] The folder should be copied directly to the disk and not in any other folder.

Below these input areas, another four inputs need to be inserted. These are the angle that the turtle turns on a corresponding symbol, the number of derivations of the string generation process, the length of the drawing section and its width (Figure 1-2).

Figure 1-2 Angle, Derivations, Length and Width input areas

It is not required to fill all the fields available to construct a model. In a case of a parametric string, only the derivations number is required. Parametric strings though are only available for three-dimensional model. In the case of non-parametric strings, all the inputs should be field (if the model is not 3D, the width may not be entered).

The final text area on the GUI, which is not editable though, is an information window that displays information about the operation on which the process works on. An example of this window in function is shown in Figure 1-3.


Figure 1-3 Output Window

1.2   Options area

The next area of interest is the right part of the interface. This section contains all the possible options for either the two-dimensional or the three-dimensional model. The first

buttons from the top make the choice between 2D and 3D models. If the 2D model is selected, two options are available: leaves and colour. These options are independent from each other and may be both selected, clicking on the square box on the left side of the name of the option. Figure 1-4 contains an image of the model type and 2D option, when all selected.
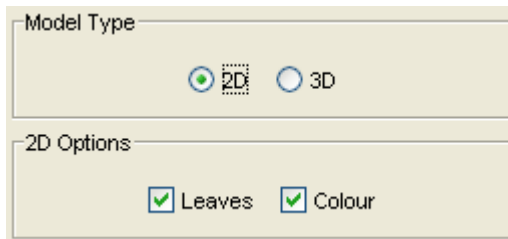
Figure 1-4 Model Type and 2D options

The 3D options contain a greater variety than the 2D ones and can be categorised in four different sets of buttons: four options of views, two shape options with different complexity for one of them, optimisations with three different options, and texture options. All these options are laid out in containing borders with headings as shown in Figure 1-5.
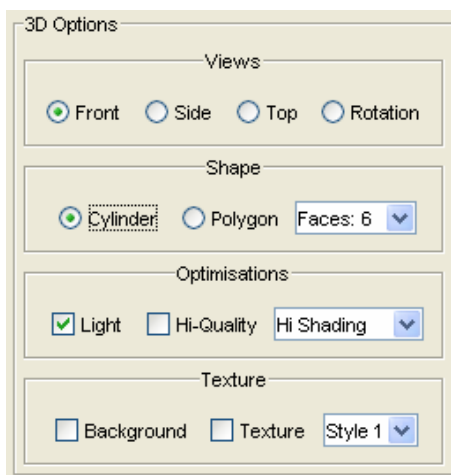

Figure 1-5 3D options

1.2.1   Views options

There are four different view options: front view, side view, top view and rotational animation. Only one of these buttons may be selected at a time by clicking on the button next to the option's name or on the name itself. The front view shows the tree from the front, as it is drawn. The next option (side view) displays the tree from the side, by a rotation of ninety degrees around its vertical axis. The top view is the view of the tree from the top, showing the branches spread out from the tree trunk. The final option provides an animation of the tree, constantly rotating around the vertical axis.

1.2.2   Shape options

Two options are available in this section: cylindrical and polygonal model shape. This option sets the shape of the section drawn for each object making the tree. If the polygon shape is selected, an additional setting is available; the number of faces making the polygon. This could be 4, 6, 8 or 12 and it may be selected from a drop-down menu, as shown in Figure 1-6. The option may be changed by simply clicking on the arrow on the side of the frame and a menu of options appears. The preferred number may be chosen by clicking on the appropriate entry.

_____

```
Faces: 6  [v]
Faces: 4
Faces: 6
Faces: 8
Faces: 12
```

_____
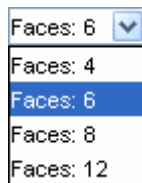
Figure 1-6 Polygon Faces Drop-Down Menu

1.2.3   Optimisations options

The optimisations options include a light option, a shading option associated with light, and a high quality option. Light adds light illuminations and shades on the tree and the

shading option, implemented in the drop-down menu, indicates the level of shading quality. The other quality related option improves the model in cases of branch discontinuities and tilting.

1.2.4   Texture options

The last set of options available in the interface provides the possibility to add textures on the tree or set a background for the image. The background is a predefined image and may be set by ticking the box next to the background text. If texture is required on the tree, the texture box must be ticked. This leads to the selection of a variety of texture options from a drop-down menu, on the right of that option.

1.3   Operation buttons

When all the required fields are filled and the options are selected, the generation process may start. This is done by clicking the 'Generate Image' button on the lower left of the interface. If help is needed for any input field or option, the 'Help' button opens a new information window with the most common issues associated with the program. To exit the program, the 'Exit' button must be pressed.

1.4   L-System values

Having explained all features of the interface, some information about the creation of trees and the program's abilities will be discussed. The program is capable of drawing any bracketed system in 2D and 3D and any parametric L-System in 3D. There are some issues though about the values that should be entered. The length in the 2D canvas is considered as the pixel length to be drawn. In the case of the window being 1024 by 768 pixels, and the turtle placed at the centre of the canvas, length values should be chosen wisely to produce trees of appropriate size. In the case of a system with four derivations,

say, an appropriate length number would be around 7 or 8 so that the tree is large enough and does not extend beyond the borders of the frame.

In 3D, the measurement system is different. The image from side to side could accommodate an object of size 1.5 approximately. This means that for a tree with around ten sections, each section should have a length of 0.1 to fit in the window. The corresponding value for the width should be about a tenth that of the length. In the case of parametric L-Systems, the length and width entered in the brackets are minimised by 1100 times. A good value then for a parametric tree length would be around 200. Examples of different L-Systems are given on the help text file 'L-System Trees.txt' on the directory of the application.