Appendices

Appendix 1 - Pajek

2.1 Installation

Pajek software for network analysis can be installed on all computers operating under Windows 95, 98, 2000, or NT. The software must be installed on the computer's hard disk. Double-click the file named `Pajek.be.exe` (Pajek book edition) and follow the instructions.

After completion of the installation procedure, Pajek can be started by double-clicking the file `Pajek.exe` which you will find in the directory where you installed the program. This directory contains additional information about the software in several hypertext files (`.htm`), which can be opened in an internet browser, and Portable Document Files (`.pdf`), which can be read with (Adobe) Acrobat Reader.

2.2 Data formats

Pajek can read network data in several plain text formats, that is, files containing unformatted text (ASCII). We will briefly discuss them in the order in which they appear on the dialog box issued by the *File>Network>Read* command (Figure 1).

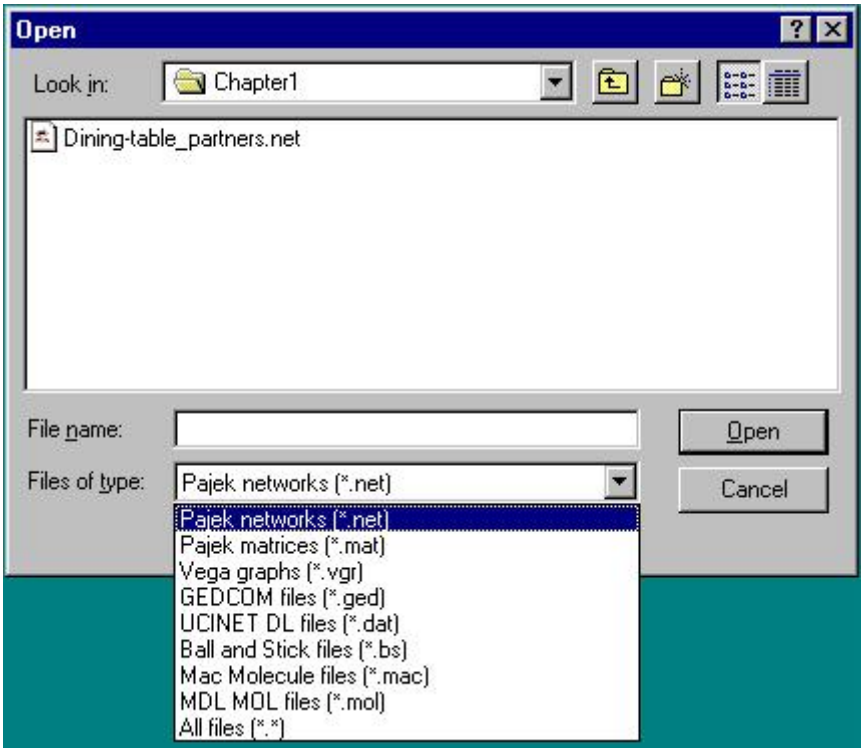

Figure 1 - *Read Network* dialog box.

The first two data formats are indigenous Pajek formats: Pajek networks and Pajek matrices. The **Pajek network** format (filename extension is `.net`) is

explained in Chapter 1 (Section 1.3.1) and additional features for longitudinal networks are discussed in Chapter 4 (Section 4.5).

The **Pajek matrix** format (filename extension is `.mat`) is slightly different. The list of vertices is the same as in the Pajek network format but the list of edges and arcs is replaced by a matrix consisting of integers or real numbers which are separated by blanks (Figure 2). This is an ordinary adjacency matrix (see Chapter 12, Section 12.2). The Pajek matrix format is very useful for importing network data in matrix format from a variety of sources.

```
*Vertices     6
    1 "Ada"                0.1646    0.2144    0.5000
    2 "Cora"               0.0481    0.3869    0.5000
    3 "Louise"             0.3472    0.1913    0.5000
    4 "Jean"               0.1063    0.5935    0.5000
    5 "Helen"              0.2892    0.6688    0.5000
    6 "Martha"             0.4630    0.5179    0.5000
*Matrix
0.000 1.000 1.000 0.000 0.000 0.000
1.000 0.000 0.000 1.000 0.000 0.000
0.000 0.000 0.000 0.000 0.000 0.000
0.000 0.000 0.000 0.000 1.000 0.000
0.000 0.000 0.000 1.000 0.000 0.000
0.000 0.000 0.000 0.000 0.000 0.000
```

Figure 2 - A network in Pajek matrix format.

The third data format is the **Vega** format devised by Pisanski. The fourth format – **GEDCOM** – is the standard data format for genealogical data, which is discussed in Chapter 8 (Section 11.3, also see the section *Further Reading*). The fourth format, **UCINET DL files**, is the raw data format of another widely used program for network analysis: UCINET. Networks exported in this format can be read by both UCINET and Pajek, so this is a way to exchange data between the two software packages. For more information about UCINET, consult the web site http://www.analytictech.com/ucinet_5_description.htm.

The last three data formats (**Ball and Stick**, **Mac Molecule**, and **MDL MOL**) originated in chemistry. These formats are not widely used in social network analysis.

2.3 Limitations

Pajek can handle networks up to 999.997 vertices. In general, drawings of networks should not contain more than a few thousand vertices because the drawing procedure is time-consuming and the drawing is visually unattractive for very large networks. By default, Pajek will not draw networks larger than 5,000 vertices but you can change this limit in the *Options>Read/Write* menu.

Available resources on the computer may pose additional limitations. It is known that the listing of results in the Report screen is sometimes restricted to a

maximum number of lines on a computer. In this case, delete (all) lines from the Report screen which you do not want to save.

2.4 Updates of Pajek

Updates of Pajek can be downloaded from http://vlado.fmf.uni-lj.si/pub/networks/pajek/default.htm. Due to modifications, newer versions of Pajek may not match the illustrations, command names, and output described in this book exactly.

Appendix 2 - Exporting visualizations

In Chapter 1, several options for exporting graphical output are briefly discussed. We will provide more details in this Appendix. In Section 2.1, we will list the viewers needed to show the exported layout of a network. Next, we will discuss the options to adjust the layout of the exported image (Section 2.2).

2.1 Viewers

Pajek can save a sociogram in six different graphical formats. Table 1 summarizes the most important information on these formats. Viewers and plug-ins must be installed on your computer before you can display the exported layout. Consult the file `PajekMan.htm` for more details on the various commands to export Scalable Vector Graphics and Kinemages.

Table 1 - Graphic formats and viewers.

Format	**Characteristics**	**Viewer**	**Software for manual editing**
(Encapsulated) Postscript (EPS/PS)	2D vector based drawing for high quality printing	GhostScript and GhostView http://www.cs.wisc.edu/~ghost/	dedicated drawing software, such as Adobe Illustrator or Corel Draw
Scalable Vector Graphics (SVG)	2D interactive representation for the world wide web	web browser and SVG plug-in http://www.adobe.com/svg/viewer/install/	Webdraw http://www.jasc.com/products/webdraw/
Virtual Reality Modeling Language (VRML)	3D interactive representation for the world wide web	web browser and plug-in: Cosmo player (http://www.cai.com/cosmo/home.htm) or Cortona (http://www.parallelgraphics.com/products/downloads)	check (http://www.web3d.org/vrml/wb31.htm) for VRML design and editing software
MDL MOL file	3D representation of the network as a molecule	web browser and Chemscape Chime plug-in http://www.mdli.com/	
Kinemages	animated sequences of images to which text can be added	Mage viewer http://www.prosci.org/Kinemage/MageSoftware.html	
Bitmap	pixel based image of the sociogram exactly as it is shown in the Draw screen	can be embedded in most Windows word processors and database software	any Windows paint program

2.2 Layout options

PostScript, SVG, and VRML visualizations need additional information about the size, placement, and colors of vertices, lines, labels, and background. This

information can be supplied with the *Options* command in the *Export* menu of the Draw screen.

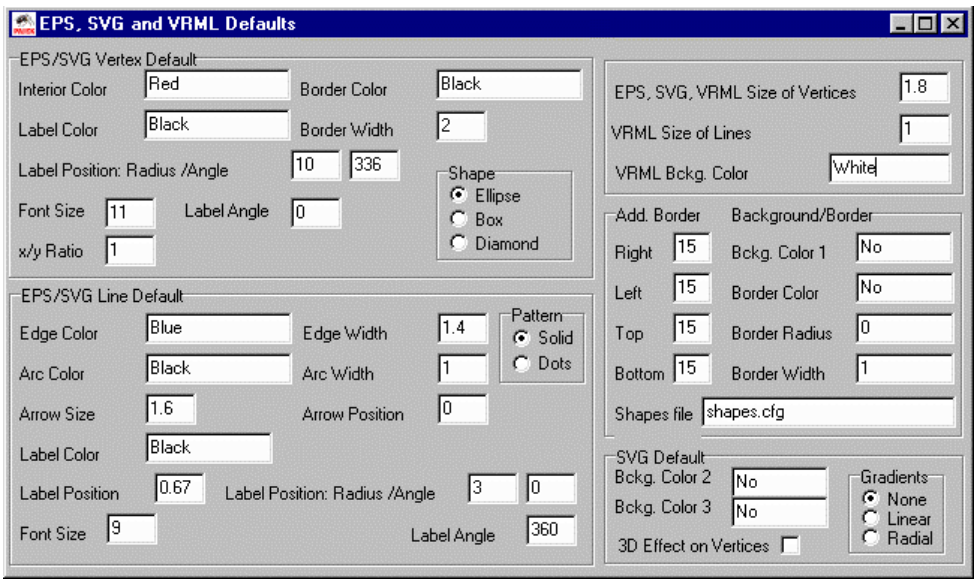

Figure 3 - The *Options* screen.

The *Export>Options* command opens a window which is divided into 5 frames, two on the left and three on the right (Figure 3). We will discuss each frame separately, but we should note first that the settings in this window will only modify the exported visualizations if they are not set in the Pajek network file. If, for instance, the color of vertices is specified in the network data file, entering a color in the *Options* window has no effect.

If you want to save the settings of a particular layout, use the *Options>Ini File>Save* command in the Main screen. This command saves all present settings to a file, which can be loaded (command *Options>Ini File>Load*) to restore the settings.

2.2.1 Top frame on the left - EPS/SVG Vertex Default

This frame defines how vertices are drawn when we export 2D layouts to (Encapsulated) PostScript and Scalable Vector Graphics. Figure 4 shows some important properties of the layout of a vertex and its label.

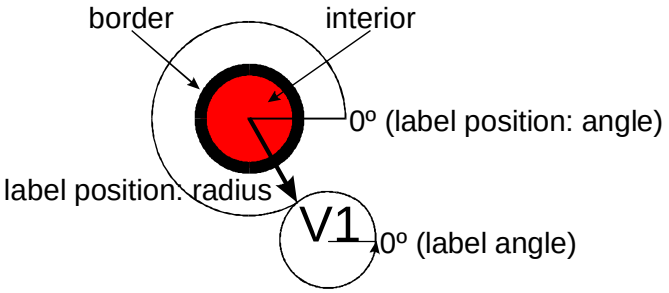

Figure 4 - Layout of a vertex and its label.

In the top frame, the color of the interior (**Interior Color**) and border (**Border Color**) of the vertices can be specified. Enter one of the colors which are listed in

Figure 6 and make sure you use upper and lower case letters as specified in this figure. The width of the border (**Border Width**) and the shape of the vertex (**Shape**) can be defined. The user may choose among the predefined shapes ellipse, box, and diamond and s/he may 'squeeze' or 'stretch' the shape horizontally by adjusting the x/y ratio (**x/y Ratio**). If this ratio is smaller than one, the shape of the vertex is squeezed, if it is larger than one, it is stretched. In Figure 5, the horizontal diameter of the vertex on the left is half the vertical diameter, so it's x/y ratio is 0.5. The horizontal diameter of the other vertex is 50 percent longer than the vertical diameter.

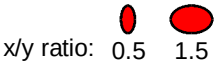

Figure 5 - The x/y ratio of a vertex.

Figure 6 - Colors in Pajek.

The color (**Label Color**) and font size (**Font Size**) of the label can also be adjusted in this frame. Again, use names of colors as listed in Figure 6. In addition, the orientation of the vertex label (**Label Angle**) can be changed relative to a horizontal line. Zero degrees is usually the best choice because this will display the labels horizontally. Label angles from 360 to 720 degrees

position the label relative to the to center of the layout, which can be useful when all vertices are drawn in concentric circles.

The most complicated part, however, is the position of the label with respect to the vertex. The position of the label is defined by its distance to the center of the vertex – the radius – and by the angle from the horizontal line starting at this center, ranging from 0 to 360 degrees (**Label Position: Radius/Angle**). If the angle of the label position is zero, the label is resting on this horizontal line at the right of the vertex. If the radius is zero, the label is placed in the center of the vertex. With short labels and large vertices (see 2.2.3) or high x/y ratio, the label may fit inside the vertex. To place labels outside but near their vertices, enter a positive number in the **Label Position: Radius** field. It is difficult to give a general rule for a good size of the radius, because it depends on the size of the vertex and the size of the label's type font. Most figures of this book used the sizes shown in Figure 3.

2.2.2 Bottom frame on the left - EPS/SVG Line Default

This frame defines the way the lines are drawn when 2D layouts are exported to (Encapsulated) PostScript and Scalable Vector Graphics. It contains fields defining the appearance of lines and line values or line labels as well as fields which specify the orientation of labels and their location with respect to the lines to which they belong.

The colors of edges (**Edge Color**), arcs (**Arc Color**) and labels (**Label Color**) can be changed by entering names of colors as they appear in Figure 6. Note that arcs and edges may receive different colors. You may draw all lines as dotted lines by selecting *Dots* in the **Pattern** field. The width of edges (**Edge Width**) and arcs (**Arc Width**) may also differ; it is good practice to draw edges a bit wider than arcs. The size of the arrowhead (**Arrow Size**) is specified independently of the arc's width. The size of the labels is defined by their font size (**Fontsize**), which should be smaller than the font size of the vertex labels for pleasant results.

You may decide where to place the arrowhead on the line (**Arrow Position**). A number between 0 and 1 is interpreted as a proportion expressing the relative distance from the end to the beginning of the arc, e.g., 0 will place the arrowhead at the end of the arc near the terminal vertex and 0.5 will situate the arrowhead in the middle of the arc. A distance larger than 1 is interpreted as an absolute distance from the terminal vertex. This is useful if you want to have all arcs on the same distance from terminal vertex, regardless of the arc's length. You have to experiment a little to find a pleasing distance.

The remaining fields concern the orientation and position of the line label, e.g., it's value, with respect to the line. Figure 7 illustrates the relevant parameters. First, the position on the line (edge or arc) must be chosen to which the line label is attached (**Label Position**). This is similar to the position of the arrowhead: numbers between 0 and 1 are proportions, that is, relative distances from the end to the beginning of the line, and numbers above 1 are absolute

distances from the end of the line. In Figure 7, the label position is 0.67, so it is located at two thirds of the arc, measured from its end. Note that edges do not have a start and an end, so it is most appropriate to position the edge labels halfway.

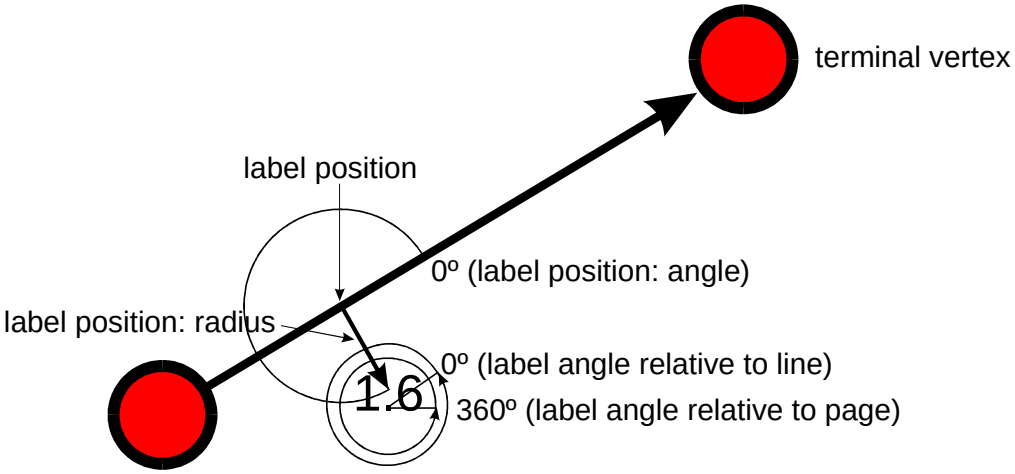

Figure 7 - The position and orientation of a line label.

Next, the location of the center of the label with respect to the position on the line is defined by two properties which are similar to the location of vertex labels: radius and angle. The radius (**Label Position: Radius**) is the distance between the position on the line and the center of the line label which is measured at the specified angle (**Label Position: Angle**) from the line. In Figure 7, the angle is 270 degrees.

Finally, the orientation of the line label is defined in the **Label Angle** field. An angle smaller than 360 degrees is measured relative to the direction of the line, where 0 degree is parallel to the line. Angles of 360 degrees and more are relative to a horizontal line. For easy reading, an angle of 360 degrees is optimal because it displays line labels horizontally.

2.2.3 Top frame on the right

This frame defines additional defaults when we export layouts to Virtual Reality Modeling Language (VRML). The field **EPS, SVG, VRML Size of Vertices** specifies the default size of vertices when exporting to VRML but also to EPS and SVG. The diameter of lines in VRML can be changed in the **VRML Size of Lines** field. It is difficult to give general rules about optimal settings for these fields; you have to experiment.

In the **VRML Bckg. Color** field, finally, you can choose a background color for the layout in VRML: just enter one of the color names listed in Figure 6.

2.2.4 Middle frame on the right

This frame defines additional properties of the network layout when we export layouts to Encapsulated PostScript and Scalable Vector Graphic. Most fields relate to a border around the layout. With the four fields **Right**, **Left**, **Top**, and

Bottom, you can add additional space to the right, left, etc. of the picture. This is effective for SVG exports and for EPS exports when the *EPS Clip* format is selected.

The color of the border (**Border Color**) as well as the background (**Bckg. Color**) can be picked from the color names listed in Figure 6. Enter the word *No* in these fields if you do not want a border or background color. The shape of the borderline is characterized by the fields **Border Radius** and **Border Width**. If the radius of the border is zero, the border is a rectangle. Higher values, e.g., 10, 50, or 100, round off the corners. A border width of one unit produces a rather thin borderline and higher values yield a fatter borderlines.

Finally, this window contains a field in which a file can be selected with custom shapes for vertices. The default is the file `shapes.cfg`. Defining custom shapes demands knowledge of the PostScript language.

2.2.5 Bottom frame on the right - SVG Default

The last frame contains additional options for exporting Scalable Vector Graphics. These layouts can handle gradient colors: an area in which one color gradually blends into another color. You can specify three colors. The first color is the background color defined in the middle frame (see Section 2.2.4). The second color can be selected in the **Bckg. Color 2** field. Use the color names of Figure 6 and enter the word *No* if you do not want to use a second color, hence no gradient. If you like, you can select a third color in the **Bckg. Color 3** field. The type of 'blend' can be selected in the **Gradients** field: *Linear*, or *Radial* (see Figure 8). In a linear gradient color, the original background color is at the top of the area blending into the second and third colors on its way down. The middle of the drawing is painted by the original background color in a radial gradient. Figure 8 also shows the effects of the **3D Effect on Vertices** option.

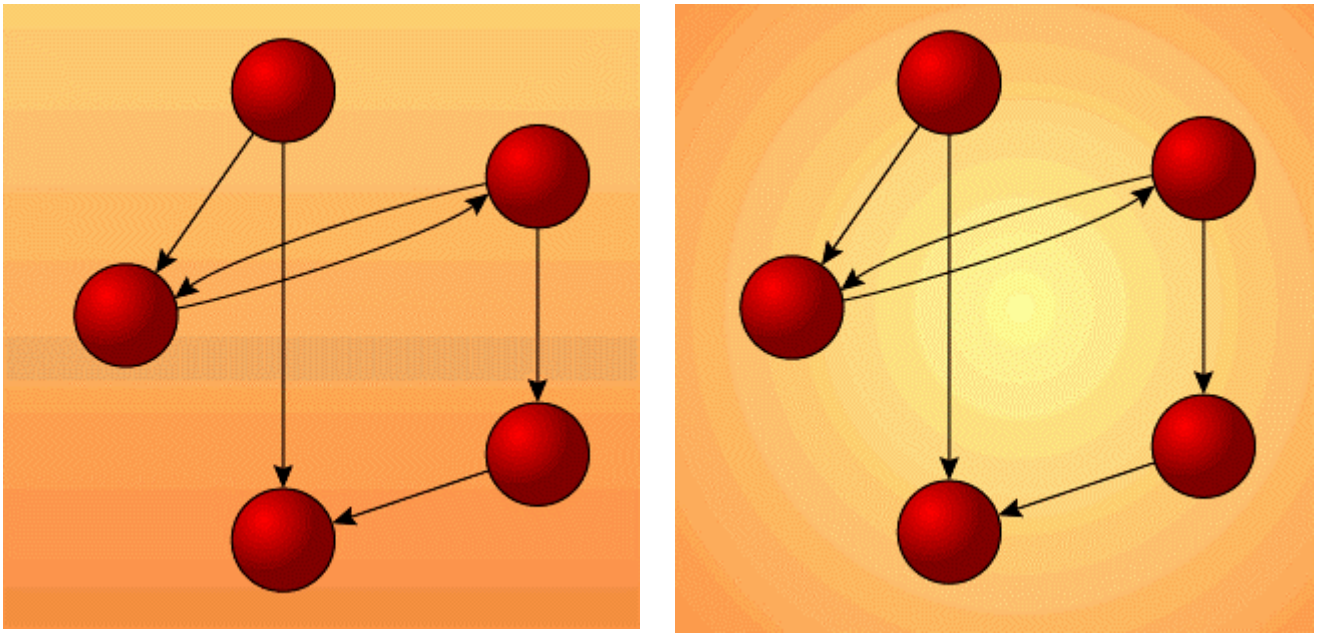

Figure 8 - Gradients in SVG export: linear (left) and radial (right).