

ArchEd

A program for drawing Harris Matrices

Christoph Hundack

Petra Mutzel

Igor Pouchkarev

Barbara Reitgruber

Barbara Schuhmacher

Stefan Thome

Preface:

This program was developed in part during the practical programming course “Automatic graph drawing“ at the MPII, Saarbrücken, Germany.

This project will be continue at the technical university of Vienna, Austria.

The authors want to thank I. Herzog and Prof. I. Scollar for their support, and C. Bridger, A. Fuller (now British Museum), and S. Lütgert for supplying data.

Also we want to thank Prof. Peter Stadler, Prof. Wolfgang Neubauer (both from Vienna Institute for Archaeological Science) for their support, and David Bibby for his helpful suggestions.

Contents:

Overview.....	4
The program Window.....	5
Your first Harris matrix with ArchEd.....	6
User Guide.....	8
A. Opening and saving of documents.....	8
B. Input and Manipulation of Harris matrices.....	11
C. Automatic Redrawing and its options.....	16
D. Printing functions and Page setup.....	18
E. Import / Export.....	21
F. Other program functions.....	23
G. Help functions.....	28

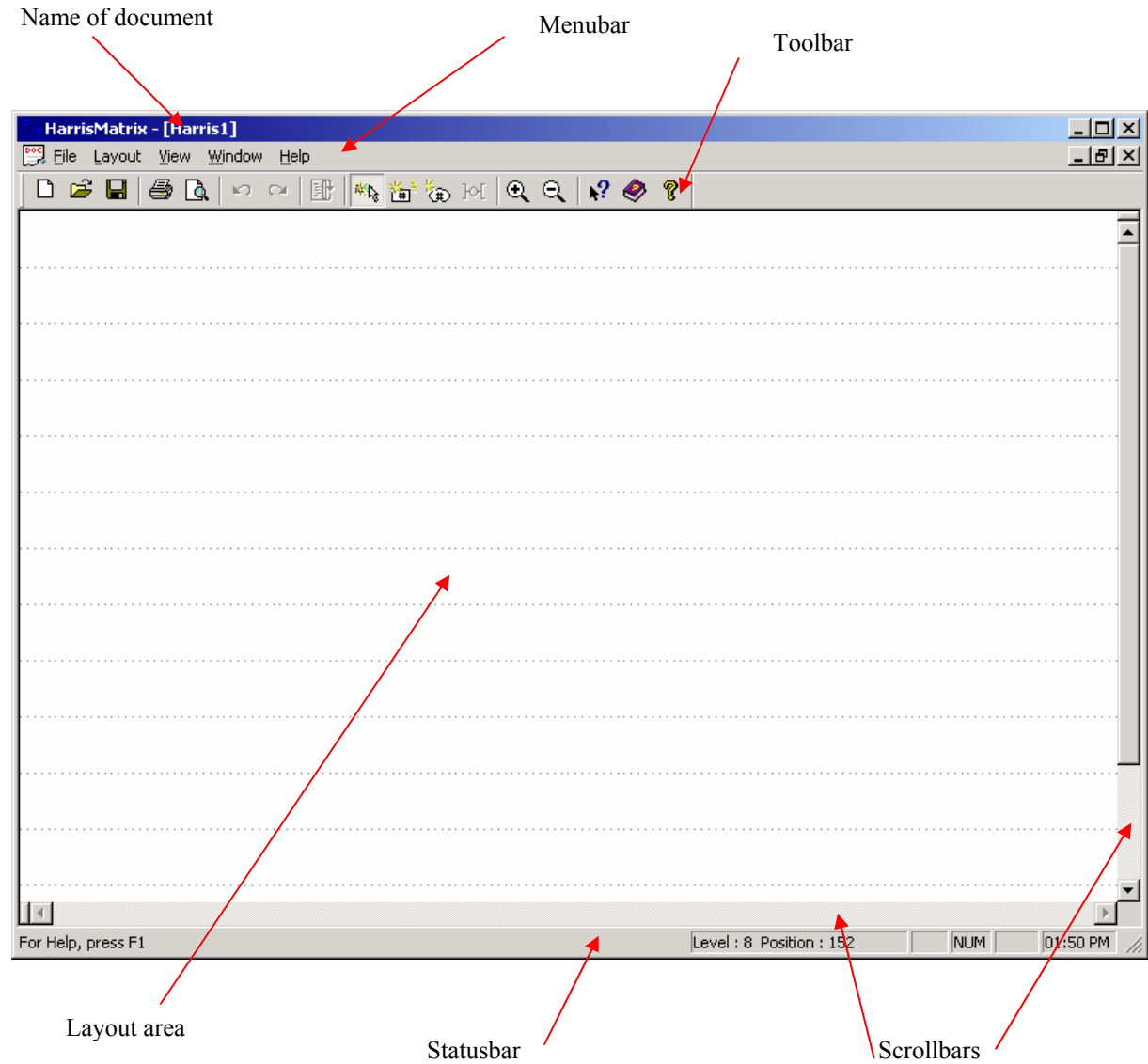
Overview:

In the following parts of this manual we will use some special terms in order to describe how to use ArchEd. For some users these expressions may not be clear, so we give a short explanation of them here:

„Clicking“ means „pressing the left mouse button once“. Accordingly „double - clicking“ means „pressing the left mouse button twice (with a very short delay between the two clicks)“ and „Right - clicking“ is the same as „pressing the right mouse button once“.

The program window:


Starting ArchEd, you see the window below. An empty default document is opened, called Harris1. In order to work with a Harris-Matrix diagram either you choose to use this document in case you want to create a new diagram or you open an existing document.




Creating your first Harris matrix with ArchEd:

In the precedent chapters you have already seen how to install and start ArchEd. Now let's see how a Harris matrix can be created. You have already seen the program window before. If you don't understand one of the following terms, please have a look at the preceding chapters to get information about it.

A Harris matrix mainly consists of two elements: The strata and the relations between them. In ArchEd both of them can be created easily.


In order to create a stratum click at  in the Toolbar.

Now you see that the cursor's shape has changed. Point this cursor to the position in the Layout area where you want the new stratum to be placed. Then simply click there and you will notice that the stratum has been created. You can now go on entering strata (notice that the cursor hasn't changed its shape) and should do so two or three times in order to be able to follow the next steps.

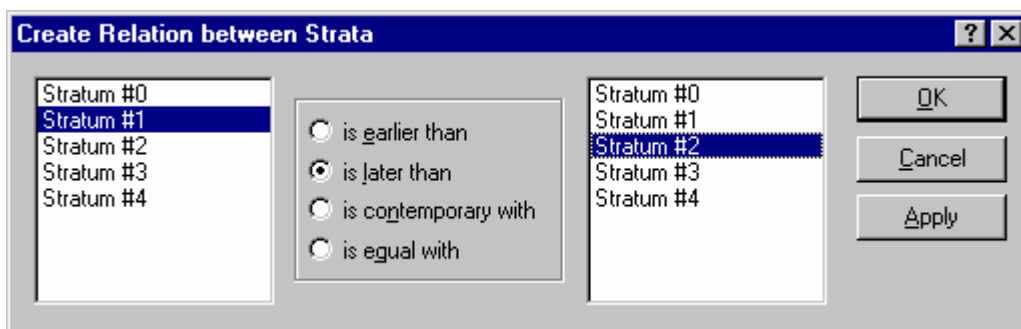
To stop creating strata, click  in the Toolbar.

Now the cursor changes back to its standard shape and you are allowed to choose a different menu or button again.

In the next step we are going to add some relations to our Harris matrix.

To do so click at  in the Toolbar.

Now a new window opens:



You see two lists of strata. In the middle of the window you see all types of relations that can be created. To create a relation between two strata just choose the first respective stratum in the left list. Then choose the second stratum in the right list and finally the type of relation you want to create between them. In our example choose „Stratum #1“ in the left list and then „Stratum #2“ in the right list. Clicking at „is later than“ and then „OK“ creates the relation „Stratum #1“ is later than (i.e. is above) „Stratum #2“ and closes the window. Choosing „APPLY“ instead of „OK“ would have created the same relation leaving the „Create relation“ window active waiting for more relations to be created.

If you aren't satisfied with your Harris matrix you can of course change its look:

- To move a stratum click at the stratum you want to move and keep the mouse button pressed. Then drag the stratum to the desired position and release the mouse button. The relations of this stratum are dragged to the new position automatically.

Relations can also be moved:

- To move a relation click at the relation you want to move and hold the mouse button down. Then drag it to the desired position and release the mouse button. Relations that lead over several levels consist of several segments, one segment for every level they are leading through. Notice that you cannot move a relation's segment to a different level.

The strata's labels can be changed easily: Just double-click at the respective stratum and its property sheet opens. Double-clicking at the Stratum's label there allows you to enter a new label.

Of course that's not all you can do with ArchEd. If you want to learn more about ArchEd's capabilities you should read the next chapters as well. There we will show you how to open and to save documents, how to import data from other programs and many other things you can do with ArchEd.

User Guide

Generally ArchEd offers two bars to interact with the program.

The program can be completely controlled via the Menubar. For frequently used options there are buttons in the Toolbar.

The Menubar:



The Menubar consists of five main menus. Each menu opens by clicking it or by pressing „CTRL” together with the respective underlined letter. For example, pressing „CTRL” together with „F” on the keyboard opens the File menu.

The Toolbar:



The Toolbar consists of seventeen buttons, each of them activated by simply clicking it.

A. Opening and saving of documents:

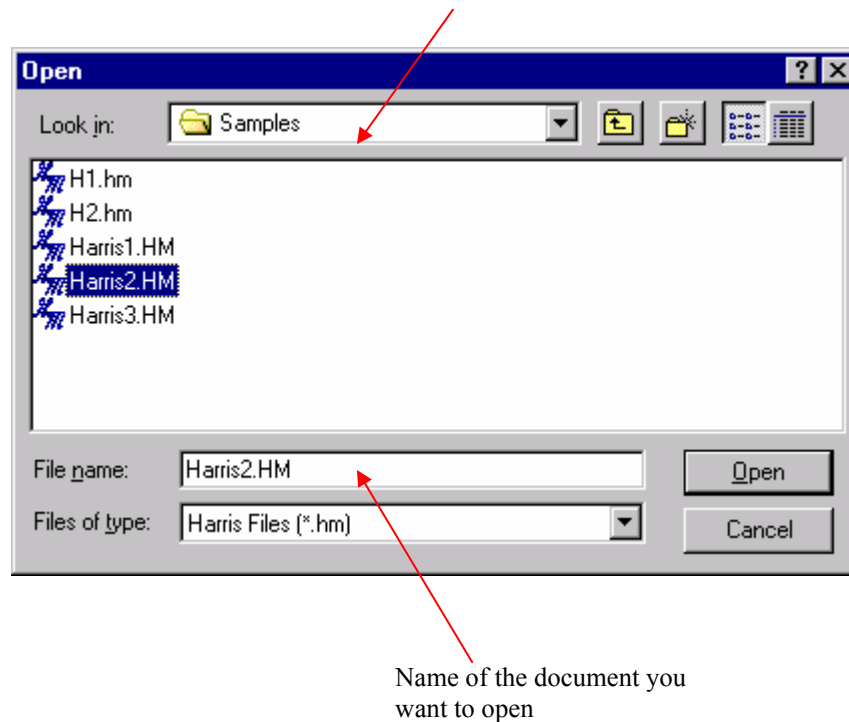
Whether you are opening an existing document or creating a new one, this document always becomes the „active” document. This means that this document receives all your commands until you click at another opened document window to set this one to „active” or you open another document.

As soon as ArchEd has been started, a new empty document is opened, called „Harris1 “. You now have two options: Either create a new Harris Matrix using this new document (and give it another name by saving it later) or open a previously saved document.



To open a document click at  in the Toolbar or at „OPEN“ in the File-menu.

Both alternatives will result in starting the „OPEN“- window. There you can select the path and the name of the document you want to open. By default, this window only lists files with the “*_.hm*” - extension. Other files are listed by selecting “All Files” instead of the “*_.hm*” - extension.


A document is always opened in a separate window.



In the „OPEN“- window select the folder where the desired document can be found and double-click at the document you want to open.

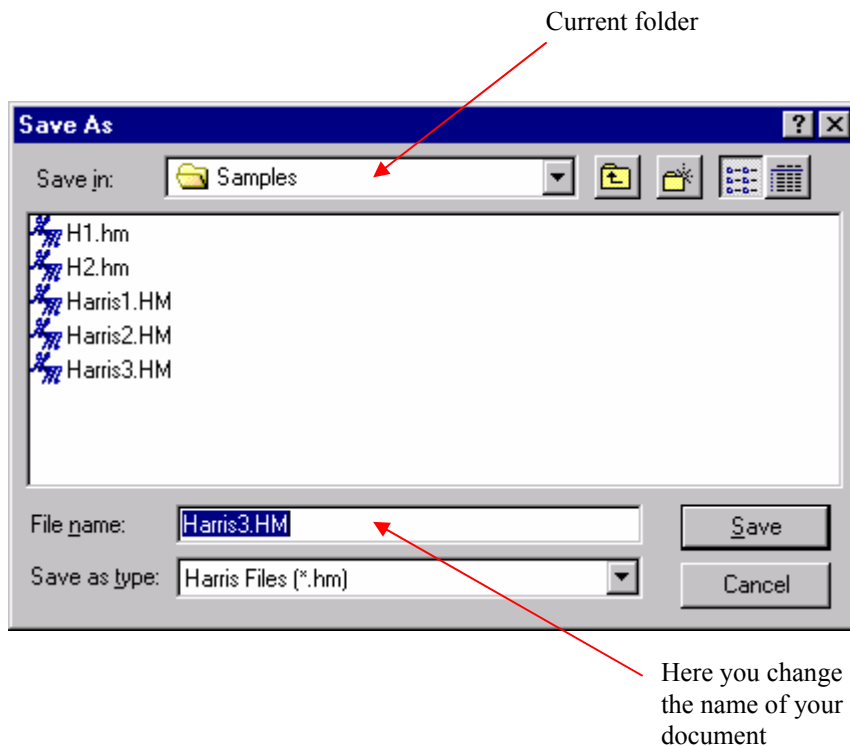
In case you need a new empty document to work with,  select  in the Toolbar or „NEW“ in the File-menu. The new document is called „Harris_X“ by default, „X“ being a number.

When you have finished the work with your document, saving it is as easy as opening a document. You can click at „CLOSE“ in the File-menu. This closes the „active“ document. In case you did not save this document before, you are prompted as to whether you want to save it or not.

To save a document directly click at  in the Toolbar or at „SAVE“ in the File-menu. In case the document you want to save has not been saved before, a window is opened where you can give a destination path and a name for the file you want to save. If the document you want to save has been opened before in the current path, it is saved at the same place under its previous name. For a document that still has its default name, which was given to it when it was generated, the program asks you to insert the path and name under which the file will be saved.


If you want to save your document under a different name click at „SAVE AS“ in the File-menu. A window similar to the one below is opened where you can give a destination path and a name for the file you want to save.

All the files you save have the extension „.hm“ by default. If desired this can be changed for your file when you type the name together with the new extension in the „Save As“-window.




B. Input and Manipulation of Harris Matrices

Entering strata:


The most simple way to add strata is to click at  in the Toolbar. You can also select „STRATUM“ and then „ADD“ in the Layout-menu.

This will change the shape of the cursor to . You can now place a stratum by simply clicking to the desired position in the layout area.

After you have placed a stratum you will notice that the cursor doesn't change its shape. This indicates that you can go on placing strata. In case you want to place some more strata you don't need to enter this „strata adding mode“ again as long as you have not left it.

To leave this mode click at  in the Toolbar, press the ESC - key on the keyboard or click at „SELECT“ in the Layout-menu.


New:

If you want to draw a surface you have to click at  in the Toolbar, or you can select “SURFACE” and after that “ADD” in the Layout-menu. Everything you do with a stratum you can do it with a surface also on the same way.

Selecting a stratum:

A stratum is selected by clicking (not double-clicking!) on it. The stratum will change its color to indicate this. Selecting a stratum is useful if you want to delete it or you want to create a relation with the selected relation as a part of it.

Entering relations:

There are two ways to add relations to a Harris Matrix. In the first case you select one of the two strata that shall take part in this relation. In the second case you directly click  at in the Toolbar or select „RELATION“ and then „ADD“ in the Layout menu.

Note that you cannot select this option until at least two strata exist.

Now a window opens:

On the left side and the right side respectively, there are lists of all existing strata.

If the lists are longer than the space in the window, you can use the scrollbars to find the desired stratum.

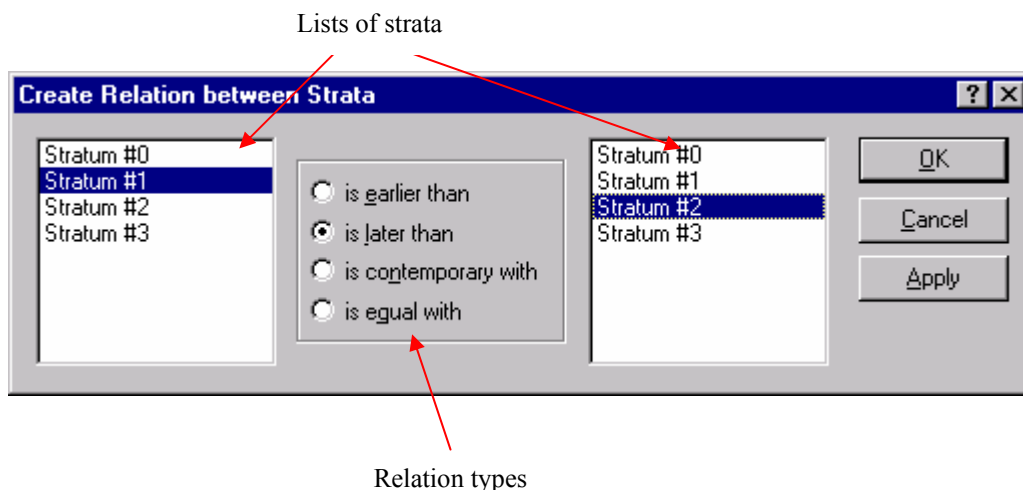
In the middle of the window you can see four types of relations:

- is later than
- is earlier than
- is contemporary with
- is equal with

Generating a relation between two strata is very simple:

In each list you choose the stratum participating in the relation and the type of relation you want to create between them. In case you selected a stratum before, you can see that this stratum is already selected in the left list. The relations are created as you read them in the window :

Let's say you want to create a relation „Stratum1 is later than Stratum2“. In the left list you choose the stratum „Stratum1“ and in the right list the stratum „Stratum2“. Now click „is later than“ in the middle of the window. (If you had chosen „Stratum2“ in the left list and „Stratum1“ in the right list together with „is later than“, you would have created the relation „Stratum2 is later than Stratum1“). Now you can choose „OK“ in the lower part of the window. The window closes and you can see the new relation in the Layout. If you choose „Apply“ instead of „OK“, the relation is generated and the window remains visible, waiting for the next relation to be inserted. Clicking the „Cancel“- button will close the window without generating a new relation.



Selecting a relation:

Only „later / earlier“ – relations can be selected. You can do this by clicking at the respective relation in the Layout area. Selecting a relation is useful if you want to delete this relation.

Deleting a stratum:

In order to delete a stratum click at the respective stratum in the Layout area. Then press the DEL – key on the keyboard or select „STRATUM“ and then „DELETE“ in the Layout menu.

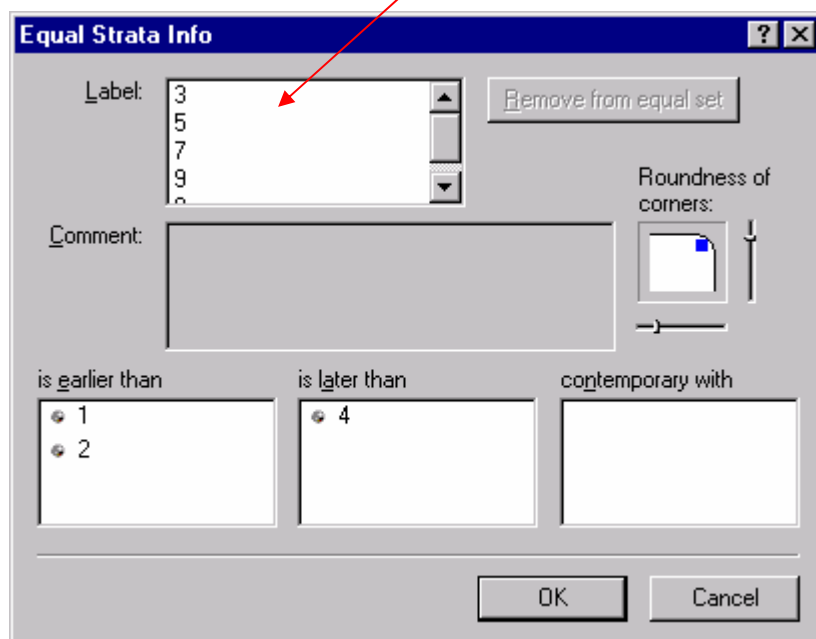
The stratum and all relations connected to it will be deleted from the Harris Matrix.

Deleting a relation:

The way you delete relations depends upon the kind of relation. Relations of the „later / earlier“ – type can be selected as mentioned above. Then press the DEL – key on the keyboard or select „RELATION“ and then „DELETE“ in the Layout menu.

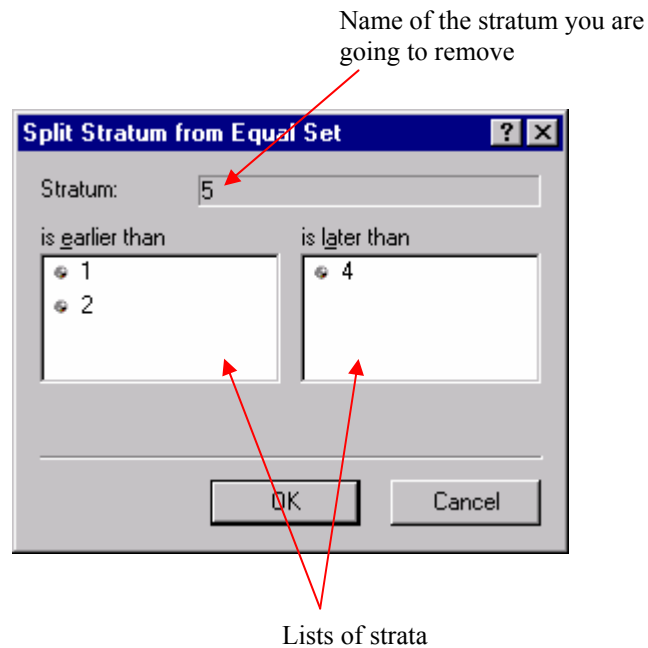
Equal relations are deleted by double-clicking at the respective set of equal strata. A window similar to the following opens:

Select the stratum you wish to delete here



Select the label of the stratum you want to delete in the list and click at the „REMOVE FROM EQUAL SET“ button.

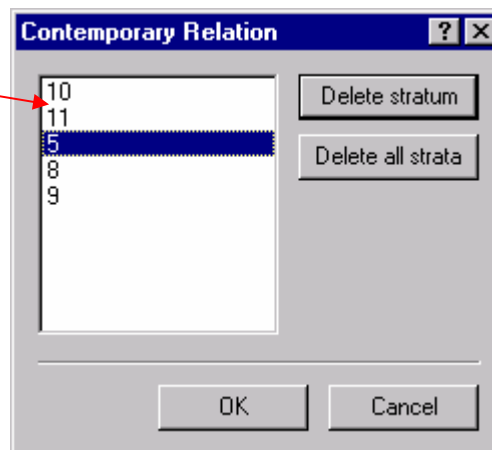
Now another small window opens. There you can decide which relation (from the original set of relations of this set of equal strata) shall belong to the stratum you are going to remove now.



The splitted stratum will receive all those relations listed in this window. In case there are relations listed you do not want for the splitted stratum just click at the respective relation and press „DEL“ on the keyboard. The relation will be deleted from the list.

Strata belonging to contemporary relations are assigned with a small number at the right of their label. To delete a stratum from a contemporary relation double-click at the right part of the respective stratum. A window similar to the following opens:

List of strata belonging to this contemporary relation



Now select the stratum you wish to delete from the list by clicking at it and then clicking at „DELETE STRATUM“. You can also delete the contemporary relations for all strata listed by clicking at „DELETE ALL STRATA“. Finally click at „OK“ for your changes to take effect.

Moving a stratum:

To move a stratum around in the Layout area click on it and keep the mouse button pressed. Then drag the stratum to the desired position and release the mouse button. Note that all relations belonging to this stratum are also moved. If you try to position a stratum in a place that is already occupied, the program will try move the other objects out of the way.

Moving a relation:

Moving a relation works in a similar way to the moving of strata: Click at the desired relation and hold the mouse button pressed until you release it at the desired position. Note that only relations of the „later / earlier“-type can be moved.

Showing the properties of a stratum:

Double-clicking on a stratum or selecting a stratum followed by clicking at „STRATUM“ and then „PROPERTIES“ in the Layout menu will open the stratum’s property sheet:

The label (=name) of this stratum

Enter any comments about this stratum here

Adjust the stratum’s shape by dragging these scroll-buttons


These lists contain all strata related directly to this stratum


In this window you can change the label as well as any comments about the respective stratum by simply double-clicking at the respective area and then entering the new text. The three lists in the middle of the window only serve information purposes: You cannot change the relations shown there by clicking there. This window also allows to change the shape of the respective stratum. To do so, click at on of the two small scrollbuttons in the upper right corner, keep the mouse button pressed, move the scrollbutton to the desired position and release the mouse button. You can also change the stratum's shape by dragging the small blue point. Moving this blue point combines the moves of both scrollbuttons and thus simplifies the changing of the stratum's shape.

All changes in this window must be confirmed by finally clicking at „OK“ . Clicking at „Cancel“ closes the window discarding any edits.

Undo / Redo of actions:

While you are working with a Harris Matrix you don't need to be worried about making mistakes. ArchEd provides an undo / redo function that allows you to reinstall the original state of your drawing easily in case you made a mistake. These undo / redo functions of the program work like the usual undo / redo functions:

Each time you click at  the program goes one step back in the list of committed operations.


Each time you click at  the program goes one step forward in the list of committed operations.

(Notice that „Undo” of a „Generate Drawing”- operation is impossible.)

Instead of using the Toolbar buttons mentioned above, you can also select „UNDO“ or „REDO“ in the layout menu.

C. Automatic Redrawing and its options

In course of the creation of a Harris Matrix you will probably notice that, as your drawing grows larger, it becomes more and more difficult to keep the drawing easily readable. Of course you could move objects around manually, but especially for large Harris Matrices this is getting difficult. For this case ArchEd provides a function, called „Automatic Redrawing“ which can be executed how often you want at any stage of your work.

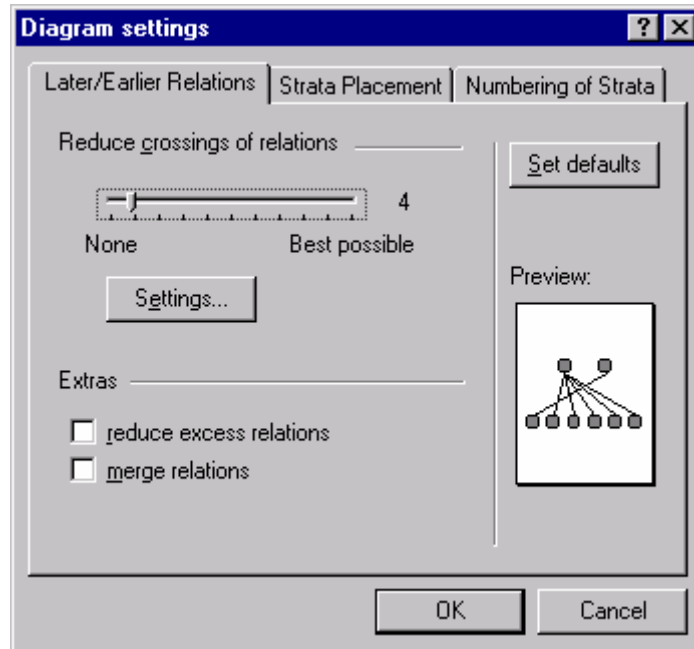
To start an automatic redrawing click at  in the Toolbar or select “GENERATE” in the Layout menu.

The program uses several algorithms to place the strata on the appropriate levels, minimize the crossings of the relations, eliminate redundant relations, and draw the Harris Matrix nicely.

Depending on your computer, the computation of larger Harris-Matrices (more than ~1000 strata) may take some time.

The redrawing process can be influenced by clicking at „SETTINGS“ in the Layout menu. A window opens where you can select from three options:

„Later / Earlier Relations“:

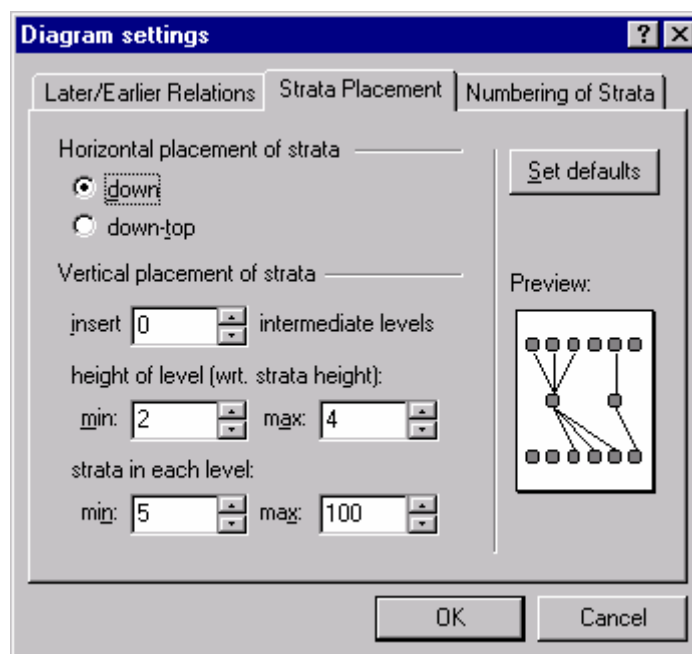


ArchEd uses heuristics to calculate the strata's positions in a way that reduces the crossings between the relations. By moving the small button in the upper left part of this window to the left or right you can decrease or increase the number of executions of these heuristics when doing an automatic redraw. Generally more executions show a better result (i.e. less crossings) but take a longer time to compute. By clicking at „SETTINGS“ you can tell ArchEd which heuristic shall be used in which „run“. Additionally you can decide to reduce

excess relations or to merge relations by checking the appropriate boxes. Reducing excess relations means that some relations that are already implicitly given by existing relations are deleted from the drawing. Activating this option may strongly increase the drawing's readability. Merging edges means that the way the relations are drawn is changed: ArchEd tries to use as many common lines for the relations as possible, whereas normally each relation consists of lines „of its own“.

Clicking at „SET DEFAULTS“ resets all settings in this window to its standard values. As you change the settings you will notice that a preview drawing in the right part of the window shows how your changes will affect the looking of your drawing.

After clicking at the „Strata Placement“ tab the following window will open:



By selecting either „down“ or „down-top“ you can decide in which direction the redrawing algorithm goes through the drawing. „Down“ starts at the top of the drawing and runs to its bottom whereas „down-top“ starts in the same way but additionally runs back to the top of the drawing. The small preview-window will show an example how these changes may influence your drawing.

In the section „Vertical placement of strata“ you can decide how many empty intermediate levels shall be inserted between every level. Additionally you can adjust the height of the levels with respect to the strata height and the minimum and maximum numbers of strata in each level.

Again, all these options will be used for the next redrawing only if you leave this window by clicking at „OK“. Clicking at „CANCEL“ will close this window and discard any edits.


The „Numbering of Strata“ window will be explained in part F. of this manual, since this window doesn't belong to the „automatic redrawing“ topic.

D. Printing functions and Page Setup:

Print Setup:

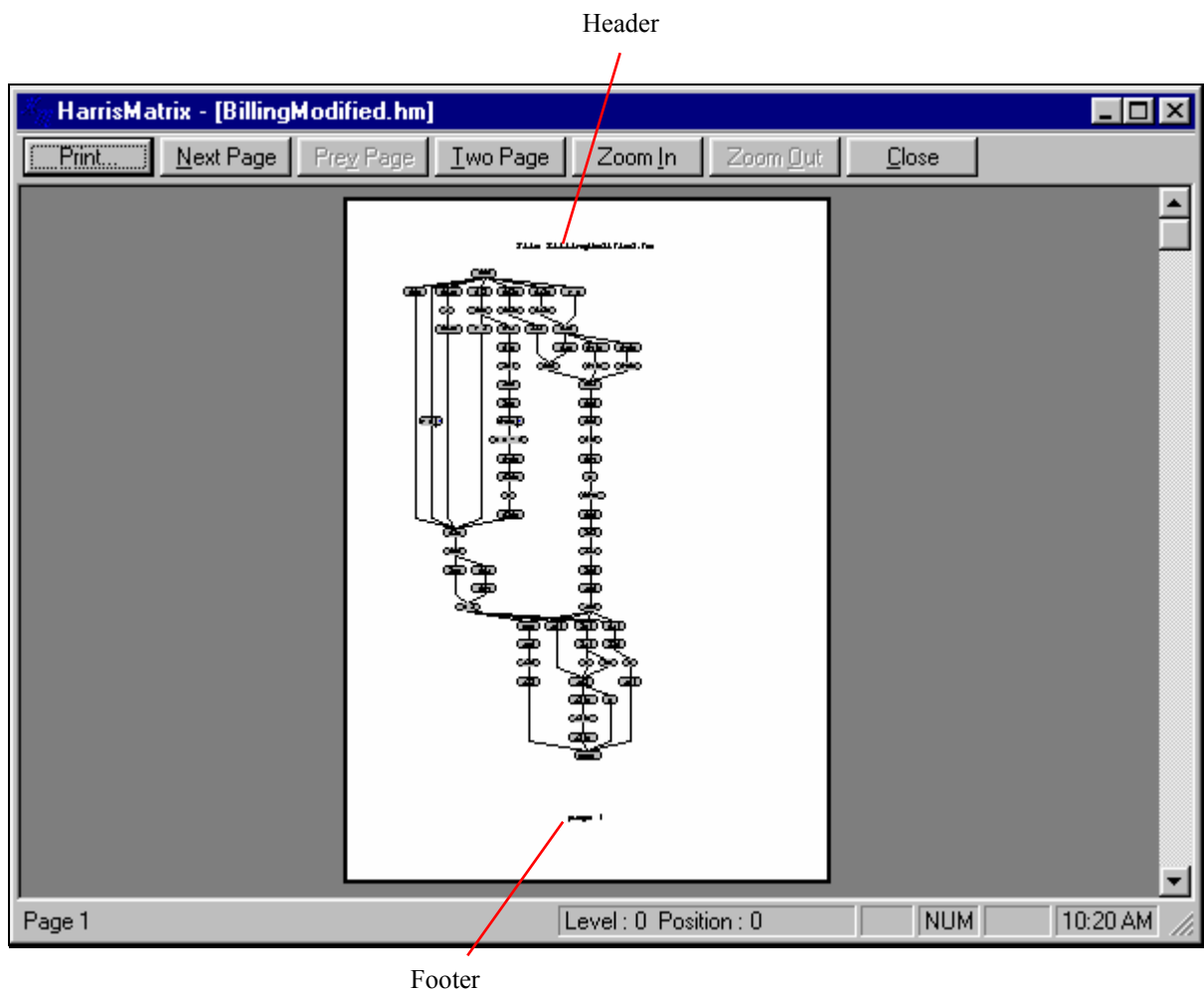
ArchEd provides several functions that help you to print your drawings. First of all, you can set up your printer in a Windows-standard manner, depending on the connected printer(s). To do this click at „PRINT SETUP..“ in the File menu. A window will open where you can change the printer options.

Print Preview:

Before printing, you can get an impression of the printout's looking by  clicking or by selecting „PRINT PREVIEW“ in the File menu:

The pages of your document are shown in the same way as they will be printed.

You can change between the different pages of your printing, zoom in or zoom out to inspect the printings and print them on paper by clicking on the respective buttons.

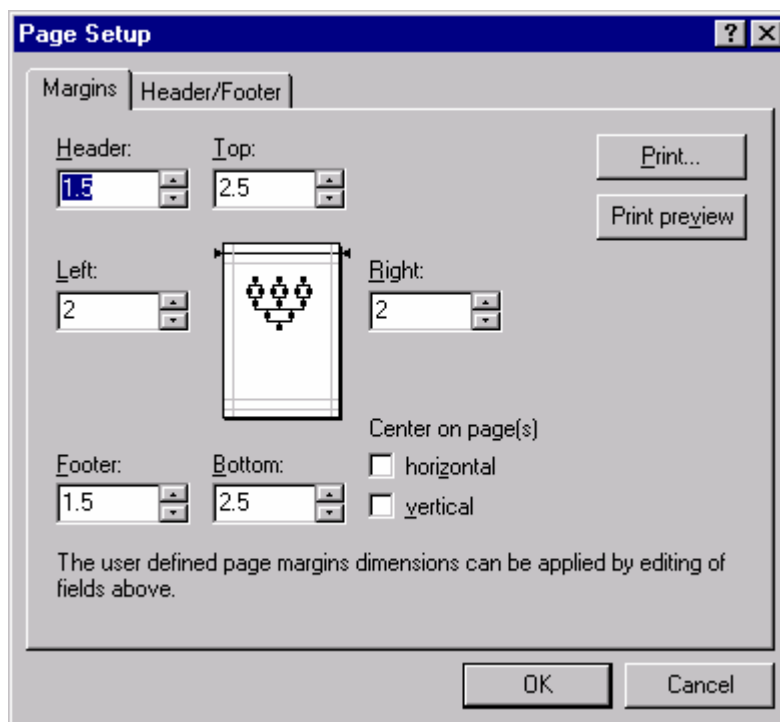


Printing:

To print a document just click  at in the Toolbar or click at „PRINT“ in the File menu.

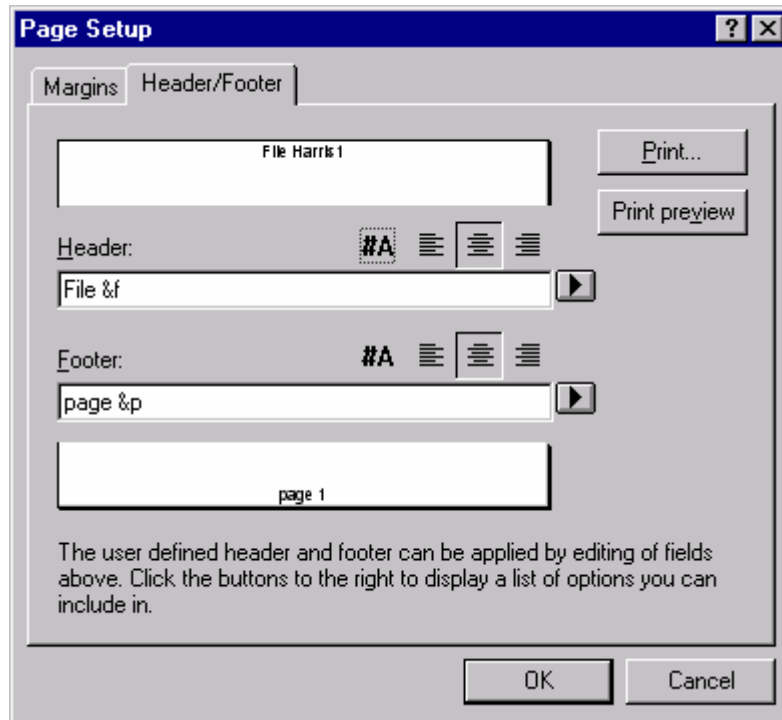
Page Setup:

By clicking at „PAGE SETUP“ in the File menu, a window is opened where you can choose between two tabs. The first tab „Margins“ allows you to set the margins and the indents for printing your document. In the center of the window a preview sheet shows the effects of your changes. Additionally you can select whether you want to center the drawings horizontally / vertically by checking the appropriate boxes.



By selecting the tab “Header / Footer” you open a window where you can add some information to your printing (in a row at the top or the bottom of the page, called “header” or “footer”). By clicking on the button to the right of the text line, you can add additional information (the current date and time, the page number, the total number of pages or the name of the diagram) to the respective part of the sheet. By selecting „#A“ you can change the font and font size for the respective part. The three buttons to the right of „#A“ let you select where to align the text of the header or footer respectively. (Align left, Center or Align right)

A sample at the top and the bottom of the window will show the effects of your changes.



The „Header / Footer“ tab as well as the „Margins“ tab contain a „PRINT“ button and a „PRINT PREVIEW“ button which have the same effect as the respective buttons mentioned above.

Again, clicking at „OK“ will make the program to accept your changes whereas clicking at „Cancel“ will close the window and discard any changes.

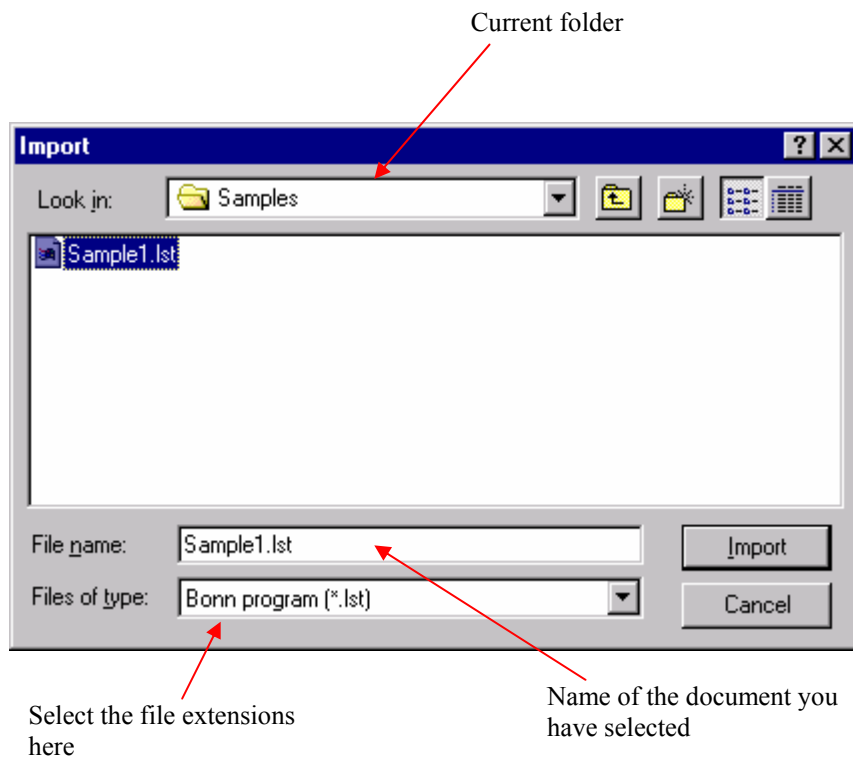
E. Import / Export:

IMPORT:

This feature allows you to open documents which have been created by other programs. File formats of the following programs are supported:

- The Bonn Harris Matrix program, which is part of the WinBasp package (extension: “*.lst*” or “*.LST*”). This format saves the drawing in ASCII format, so changes can be made via a text editor.

The Import window works similiarly to the Open window mentioned above. By selecting the file extension, you decide which kind of document you want to import. The window shows you all documents in the present folder with the selected extension. You open the desired document by double-clicking it.



EXPORT:

Opposite to the Import function, this function allows you to save your documents in one of the following formats:

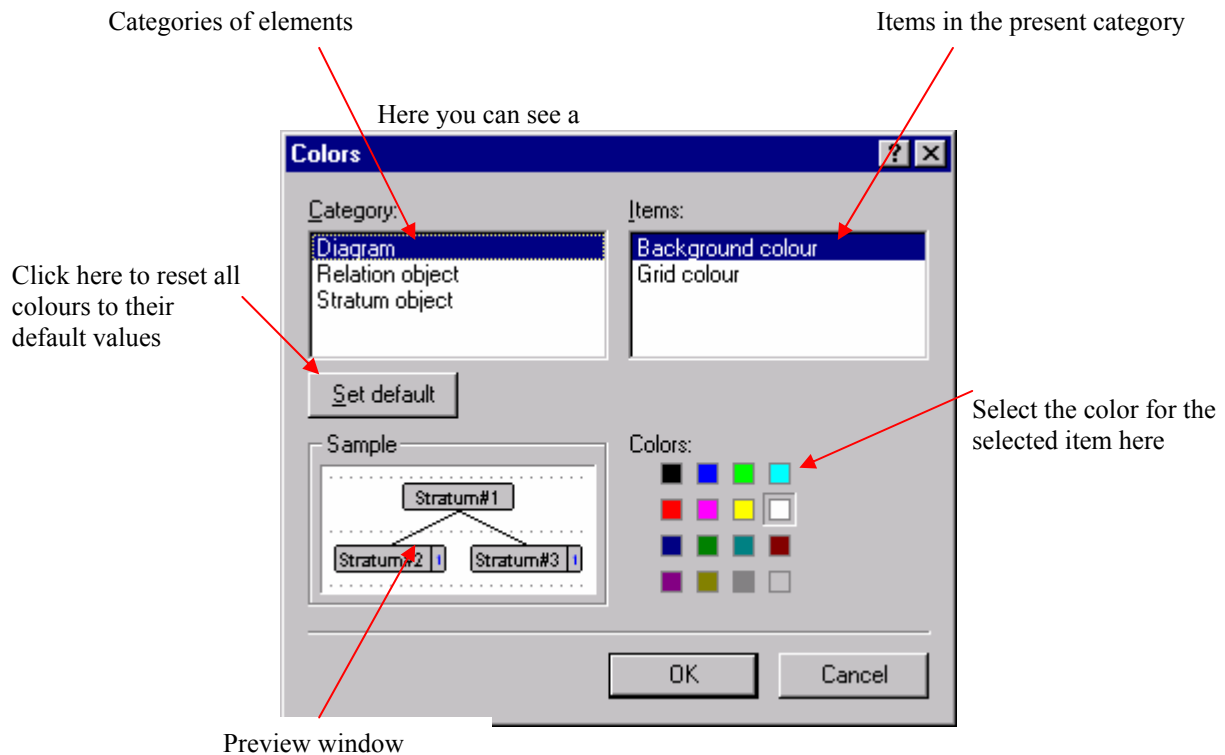
- The List format of the Bonn Harris Matrix program, which is part of the WinBasp package (extension: „*.lst*”)
- The Windows metafile format and the Enhanced metafile format (extensions: „*.wmf*“ or „*.emf*“). These formats can be used to export Harris Matrices to MSWord for example.
- The Bitmap format (in this case a 24-bit Bitmap format) (extension „*.bmp*“). Use this format to export HarrisMatrices to graphic editors as MSPaint or CorelDraw for example.

Again you select the desired format by choosing the respective extension. Apart from this, the Export window works in the same way as the Save window mentioned above.

F. Other program functions:

Changing Colors:

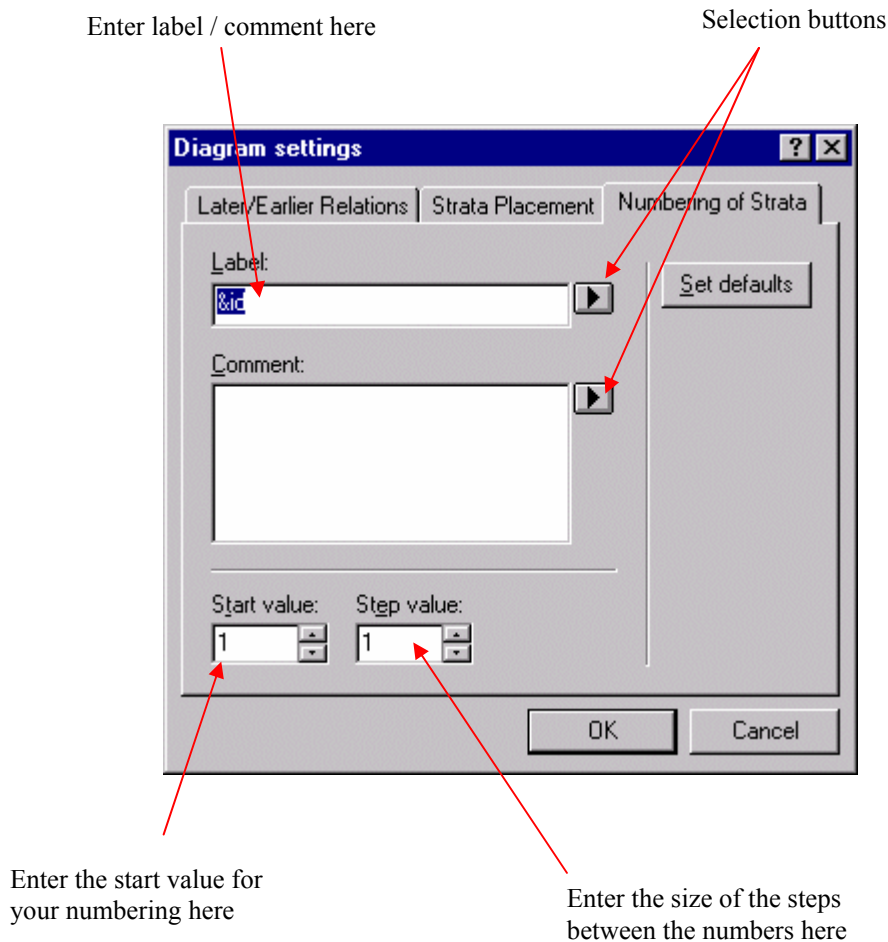
By clicking at „SET COLORS“ in the View menu the following window opens:



You can change the colors of all elements of a Harris-Matrix here. Just select the category and the item you want to change. Then you select a new color for this item by simply clicking the desired color. A preview window shows the effects of your changes.

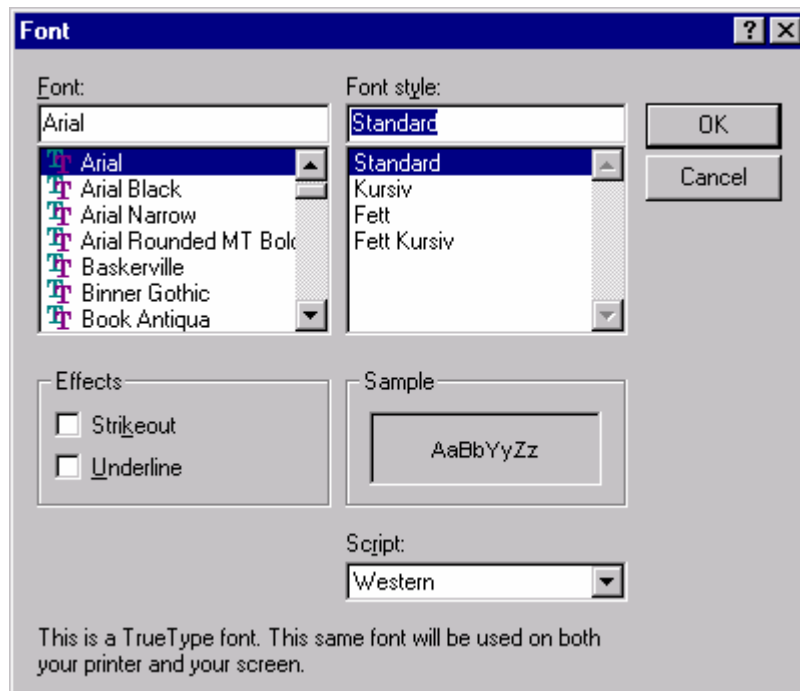
Numbering of strata:

This window allows you to specify the way strata are labeled by the program. In order to open it, select „SETTINGS“ in the View menu and then click at the „Numbering of strata“- tab. Of course you can change the label of every stratum by double-clicking it. But any new stratum will have the label specified here at the time it is created. You can also insert a default comment for your strata. On the right you can see two selection buttons. These buttons let you choose the kind of label / comment that is inserted (date and / or time for example). If you choose to number the strata, you can give a start value as well as a step value which indicates the difference between the numbers of two consecutive strata. The SET DEFAULTS button sets all options back to their default values, which means that strata are labelled by numbers and there are no default comments. You can insert static text as label / comment by simply clicking the respective area and typing the desired text there.





Setting the fonts used in the drawing:

To set the font and the font style used for the labels, comments, etc. of the drawing, click at „SET FONT“ in the View menu. The options in this window are self-explanatory. A small sample will show the effects of your changes. If you are satisfied with the settings, click at „OK“ to leave this window. Clicking at „Cancel“ will leave the window and discard any changes.



Zooming functions:

Especially for large Harris matrices it might be useful to see larger parts of the matrix or even the whole drawing at one glance. ArchEd provides functions for both cases:

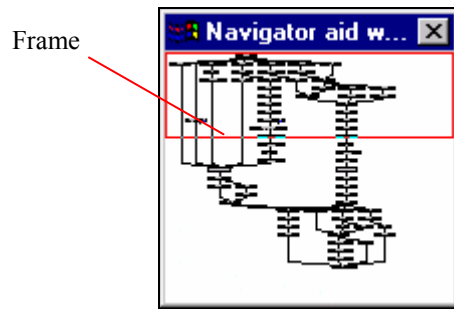
You can zoom in or zoom out your drawing by clicking  or .

(Alternatively you can click at „ZOOM IN“ / „ZOOM OUT“ in the View menu.)

This way you can either inspect some details of the drawing or get an overview of large parts of the diagram.

If you want to see more of your drawing at one glance, click at „NAVIGATE“ in the View menu.

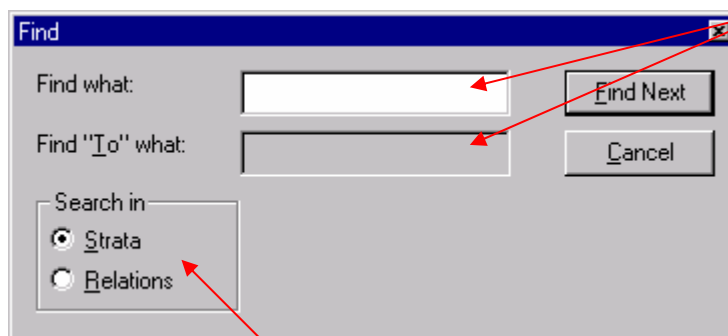
This opens a small window that shows the whole drawing together with a red frame that indicates the part of the diagram displayed on the layout area. This frame can be moved over the drawing in order to display other parts of the diagram on the layout area.



Finding objects:

Another small but helpful function that may increase the readability of your drawing is the grid shown in the Layout area. You can toggle it on / off by clicking at „GRID“ in the View menu.

In case you need to find a special stratum or relation in your diagram, click at „FIND“ in the Layout menu. A window is opened where you select the stratum or the relation respectively. After clicking at “Find Next” the layout area is scrolled to the position of the desired object and the object is highlighted in a different color.



Select here from which and to which stratum the relation, you are looking for, is leading.

Select here whether you want to find a stratum or a relation

Toolbar / Statusbar:

By default the Toolbar and the Statusbar are shown on the screen. In case you want to enlarge the space for your drawing on the screen you can toggle both bars on / off by clicking at „TOOLBAR“ / „STATUSBAR“ in the View menu.

Marking the direction of later / earlier relations:

Usually, two strata that are related to each other with a later / earlier relation are connected by a simple line in the drawing. The later stratum is drawn on a higher level than the earlier one. This assignment to the correct levels is done by an automatic redraw. However while creating a Harris matrix manually such a correct level assignment is not necessarily given which means that it is not always clear in which direction each later / earlier relation goes. To avoid such possible errors click at „RELATION DIRECTION“ in the View menu. If this option is switched on a small black rectangle will be drawn at the one end of each later / earlier relation that touches the earlier stratum.

Switching between orthogonal and direct line drawing mode:

Many users of ArchEd find it more convenient to draw the relation lines in a manner that only rectangular bends are allowed. To toggle between this mode and the default direct line drawing mode, click at „ORTHOGONAL“ in the View menu.

Arranging the document windows:

As it is usual for many windows programs, the document windows can be arranged in different ways.

By clicking at „NEW WINDOW“ in the Window menu a new window for the “active” document is opened. All changes made in one of the windows of a document are executed as well in all other windows of this document to keep consistency.

Clicking at „CASCADE“ in the Window menu arranges all document windows such that they overlap whereas selecting „TILE“ arranges all document windows as non-overlapping tiles.

Finally, clicking at „ARRANGE ICONS“ results in arranging all minimized windows in a row at the bottom of the program window.


G. Help functions:


In the case any questions arise while using ArchEd, the program contains several help functions. In order to read more about this, click at „USING HELP“ in the Help menu. An introduction of ArchEd’s Help system will be shown.


The easiest way to get help is often to click at the screen element you want to know more about and then to press F1 on the keyboard. For those screen elements that cannot be selected by clicking at them, you should try to right-click at them. Then a small window named „What’s this“ will open und you should select it by clicking it. In both cases, ArchEd will open a help file related to the momentarily used function. But as this way of getting help is in some cases not sufficient, there are some more possibilities for getting help:

In case you need help about a special topic you have two options to get more information:

Click at „INDEX“ in the Help menu and a window opens where you enter topics for which you need help. The program then shows keywords related to the desired topic and you can select from the alternatives shown.

Another possibility is to click at  or at „HELP TOPICS“ in the Help menu which opens the complete list of help keywords from which you can select the needed topic.

If you click at  and then select an element of the program window, you will get more information about the selected element.

Clicking at  or at „ABOUT“ in the Help menu will show some information on the program eg, the version number.