Version 4.0.3

BioBrowser User's Guide

By Statistics Canada

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Getting Started

Introduction

BioBrowser, the Modgen Biography Browser is a stand-alone software product which supplements the Modgen language used for dynamic longitudinal microsimulation modeling. BioBrowser allows the analyst to graph the microdata generated by the model. Its purpose is to aid in uncovering possible algorithmic errors in the model, or to study some particularly interesting cases with respect to the specified Modgen model.

Microsimulation models written in the Modgen language generate synthetic lifetimes of individual actors. Each actor is defined as a set of states which describe the characteristics of the actor. For example, an actor could be a male individual whose attributes are described through the following states: age, sex, marital status, and health status. The values of these states change as the actor progresses through his lifetime. In our example, the individual's age would change on each birthday while the marital status would change at the time point at which he/she was married, divorced, etc.

BioBrowser is a tool which allows the analyst to graphically examine the characteristics and attributes of an actor over the course of his/her lifetime. The BioBrowser can graphically present one or many states for one or many simulated lifetimes. In this way, BioBrowser complements the other reporting features inherent in Modgen which are designed to provide detailed cross-sectional information on a collection of actors at a given reference time or state.

The graphical representations produced by BioBrowser originate from a special database file which is the product of a Modgen model simulation run. Once this file has been created there exists a variety of possible graphics which the analyst can create with BioBrowser. The specifications of these graphics are controlled by the user through drop-down menus and options. Therefore, an analyst with a limited knowledge of the Modgen modeling environment can create an impressive array of longitudinal graphics showing the characteristics of the actors at different points in time. All of these graphical representations can be saved for editing at some future time and/or routed to a printer or clipboard.

Specifying the contents of the database file requires the analyst to have some knowledge of the Modgen simulation environment. A section below describes the components of Modgen with which one must be familiar to successfully create a database file. Further details can be found in the Modgen Developer's Guide.

Contents of BioBrowser

The Modgen Biography Browser (BioBrowser) installation package consists of a sample database file **demo(trk).mdb** and a sample biography file **demo.bbr**. These files are referred to extensively to provide worked examples of the browser. The nature of these files will be discussed in "How to Use BioBrowser: The Basics" on page 8.

System Requirements and User Feedback

BioBrowser has been tested on Windows XP and does not have substantial requirements for CPU, disk or memory.

Users with questions or problems with any aspect of this software are welcome to contact the development team at microsimulation@statcan.gc.ca.

Essential Components of a BioBrowser Session

Modgen components

Before using BioBrowser, it is important for the analyst to understand some of the essential components of Modgen.

database (.mdb) files

These files are created by Modgen during the simulation phase of the model. They contain the raw data necessary to construct the graphical representation created by BioBrowser. Although the database files can be read by BioBrowser, BioBrowser can never modify the contents of these files. All BioBrowser sessions begin by opening a pre-existing database file.

dominant actors

These elements are at the core of any Modgen simulation exercise. Dominant actors are usually persons or households which are created at the beginning of the simulation process and undergo changes to their characteristics as they proceed through their lives. Dominant actors are defined by their characteristics (states) and by the events which transform their states.

non-dominant actors

Modgen simulates one case at a time where a set of dominant actors undergoes changes to its states. One possible change to a person actor's state is a marriage or a common-law union. When this event has occurred, Modgen generates an appropriate spouse. This spouse, another person actor, is termed a non-dominant person actor. Once created, non-dominant actors undergo the same possible events as the dominant actors of the same type. Non-dominant actors are linked to their dominant actor.

tentative actors

The process of generating a non-dominant actor in Modgen involves generating a sequence of potential candidates. The candidates who are not chosen are termed tentative actors since they have no links to any of the dominant actors in the model.

states

These elements define the characteristics of the actors over the span of their lifetimes. Examples of states might include age, employment status, or educational attainment. States can be scalars or arrays.

Before beginning to use BioBrowser, a database file needs to be created using Modgen. If you want to examine states which are not in the database, a new Modgen simulation must be run and a new database file needs to be created. A sample database **demo(trk).mdb** was included with this software package. For more information on creating new databases in Modgen please refer to the Modgen Developer's Guide or, for a quick overview/refresher, see "Appendix: Creating a New Modgen Database File" on page 22.

BioBrowser components

BioBrowser takes the database and creates graphics of the characteristics of the actors. In addition to the above Modgen concepts, there are other concepts which relate specifically to BioBrowser.

biography (.bbr) files

These files contain the graphical representations which the analyst has created during a BioBrowser session. The biography files can be created, saved, and edited by the analyst during a BioBrowser session.

display band

The graphical display of a state or linked actor.

filter

The criteria used to narrow or refine the set of actors to be used in a biography..

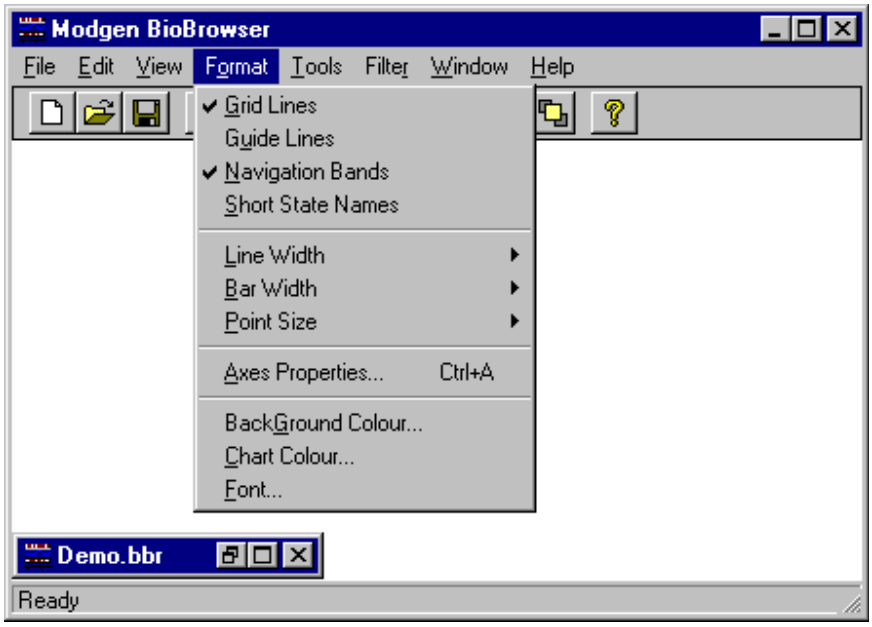
navigation band

A type of display band which also includes a set of buttons which allows the user to go from the display bands of one actor to another and add new states to the biography. The buttons resemble the control buttons on the front of a CD player.

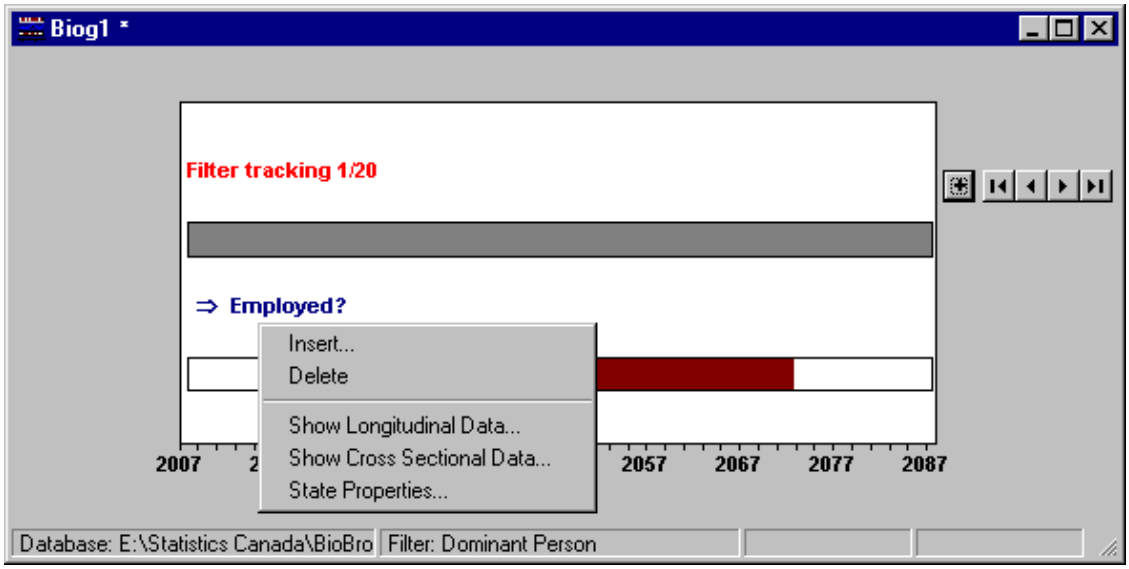
The BioBrowser Menu and Toolbar

Menu Commands

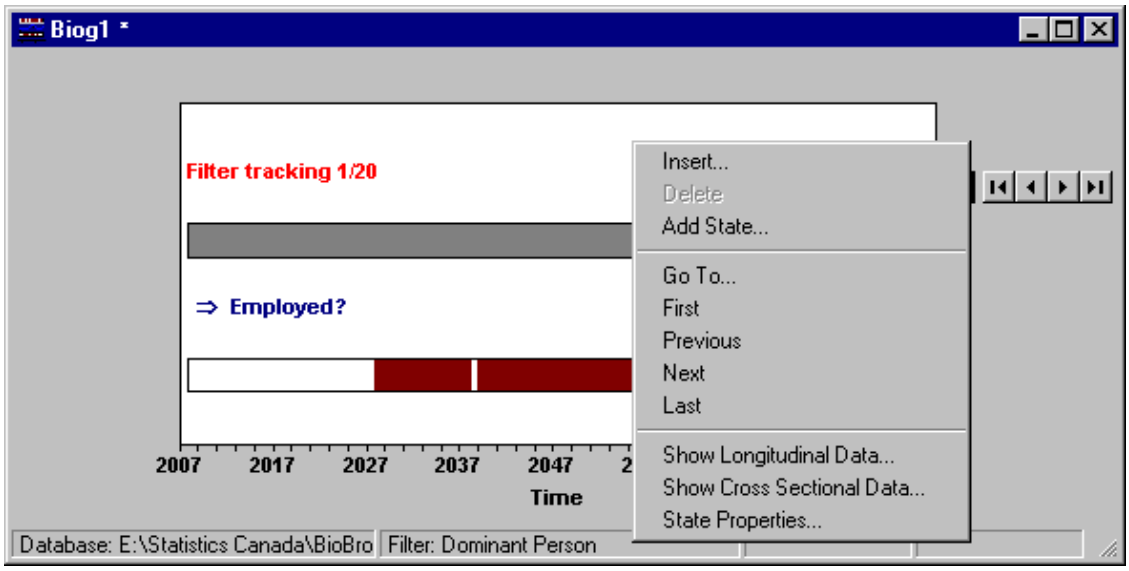
The BioBrowser menu bar contains a set of standard menus available in most Microsoft Office applications, as well as some application specific commands. Some of the same functions may be available as Toolbar buttons or through keyboard equivalents.



Pop-up menus: Some commands are only available from pop-up menus or by double-clicking on the chart area over the display bands of the desired state. Use the right mouse button click to access the pop-up menus. These menus will differ depending on whether or not the state is a simple state or a linked actor. For simple states such as “employed” below, the following commands are available:



For the filter tracking band and linked actors, access is also provided to the navigation band commands, as shown below.



The Toolbar

The toolbar provides quick access to the most frequently used menu items and commands in the BioBrowser application. Each button is described by a Tool-Tip or status bar description. If you have a small screen at low resolution you may choose not to display the Toolbar. Choose **Tools/Options** and Click on the **View Toolbar Option.**

Icon	Description	Menu Equivalent
	Create New Biography	File/New
	Open Saved Biography	File/Open
	Save Biography	File/Save
	Print active biography	File/Print
	Copy active biography to clipboard	Edit/Copy
	Undo Last Add	Edit/Undo Last Add
	Show or hide grid lines	Format/Grid Lines
	Show or hide guide lines	Format/Guide Lines
	Show or hide navigation bands	Format/Navigation Bands
	Change background colour	Format/BackGround Colour
	Change chart colour	Format/Chart Colour
	Invoke BioBrowser Help	Help/Contents

How to Use BioBrowser: The Basics

This section introduces the basics of using BioBrowser.

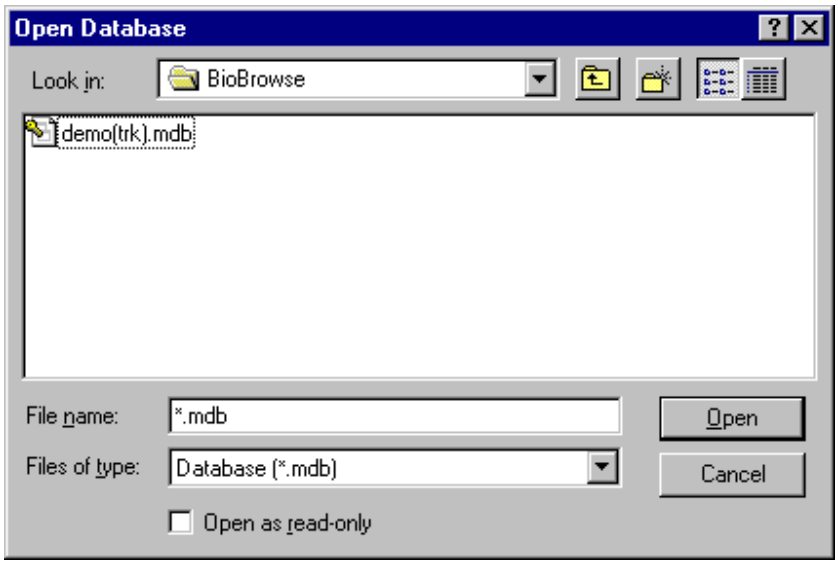
Beginning a BioBrowser Session

To begin a BioBrowser session, click the **Start** button on your toolbar, choose **Programs**, and then select **BioBrowser**.

Opening an Existing Database File: The File/Open Database Command

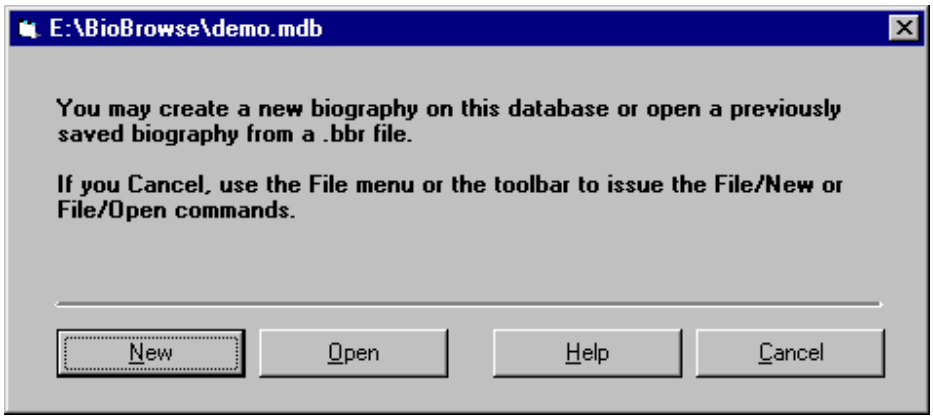
BioBrowser automatically invokes this command at the start of every session. A database file (created by Modgen) must be open before any graphical representations (saved as a biography) can be created. Although only one database file can be open at a time, any number of biographies can be viewed simultaneously.

A sample database **demo(trk).mdb** has been supplied as part of the BioBrowser installation.

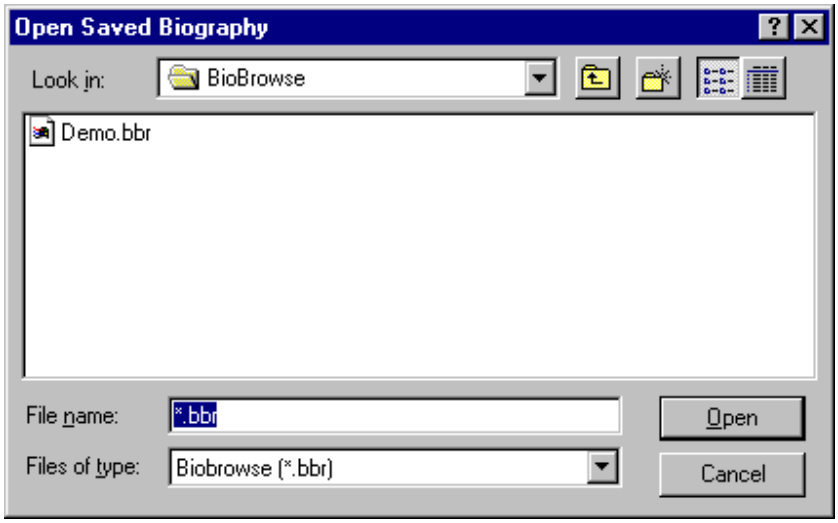


Opening a Saved Biography: The File/Open Command

After you have opened the database upon the startup of BioBrowser, you will be asked to either create a new biography or open a saved biography. One saved biography **demo.bbr** has been supplied with the installation software. Choose the Open button.



You will be prompted for the name of the saved file to open. Choose **demo.bbr**.



Creating a New Biography: The File/New Biography Command

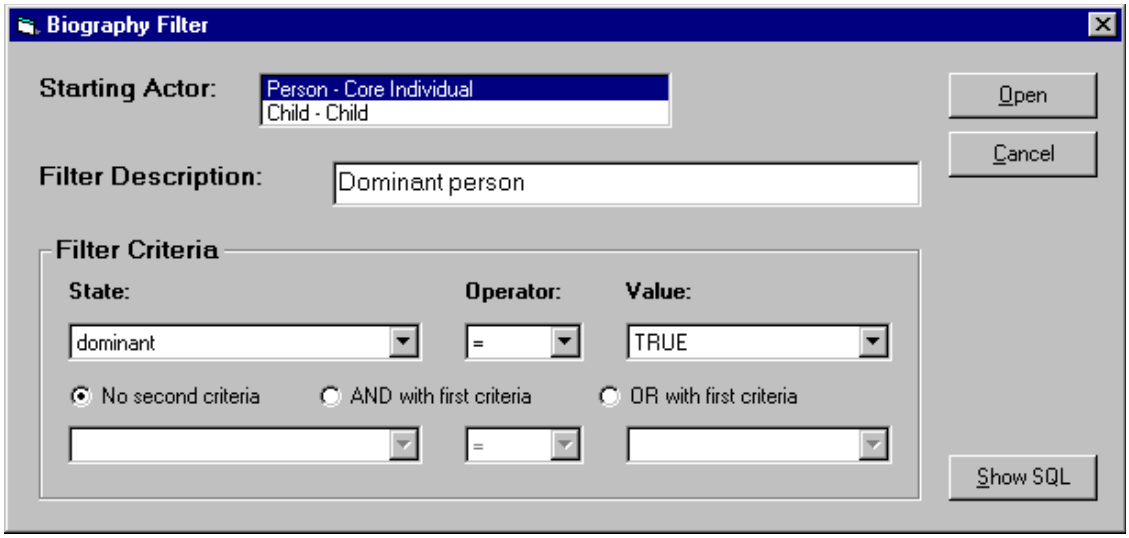
Creating a new biography involves the selection of the actors which you want to graph by choosing a starting actor and a filter. The way in which the open database was defined in the Modgen model will limit the available choices. The Starting actor is the type of actor whose state characteristics will be graphed. Other actors who are linked to these starting actors (e.g. parents, spouses or children) may be added later in the BioBrowser process. In our example, two starting actors are available: (i) persons, whose states are included in the database only if they are dominant actors or other married or remarried individuals, and (ii) children.

This choice of starting actor may give a large set of actors to be graphed, depending on the size of the Modgen database. The filter criteria enables you to narrow the focus of the biography. Select a state, an operator on that state, and a value. This generates a SQL query on the database. The result of the query is a set of actors which satisfy the filter criteria. At present, two states can be used to determine the filter. When selecting two states, you must choose if the criteria will be joined with an "And" or an "Or" condition. If the result of the query is non-empty, then a new biography is opened. Once the biography is open, you may change the criteria using menu item **Filter/Criteria**…, as discussed in "Changing the Biography Filter" on page 16.

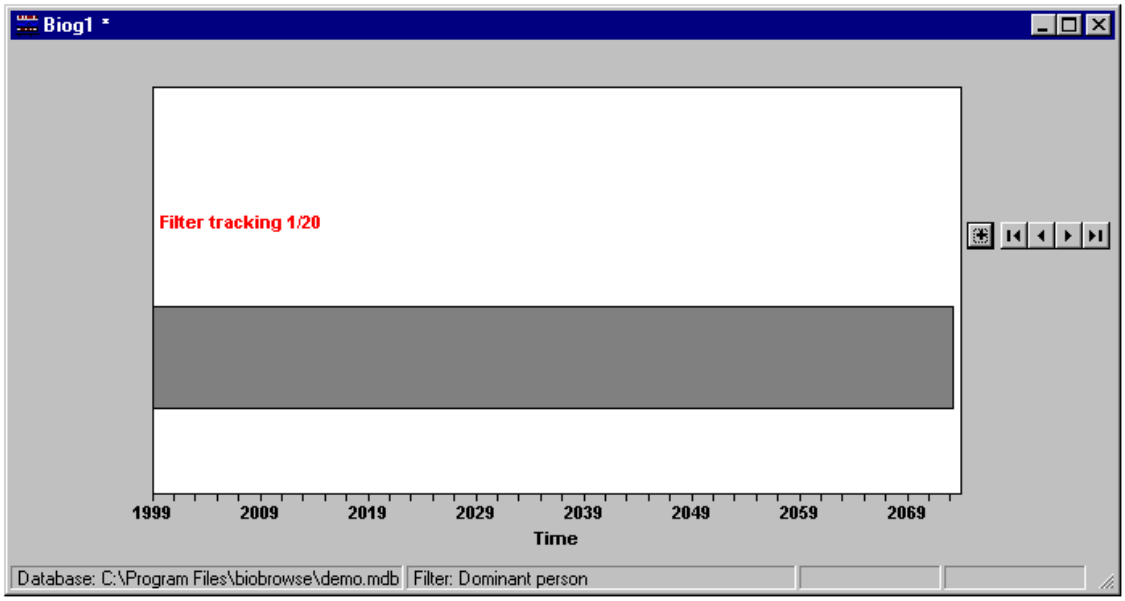
The tracking state is a variable which indicates the ranges of time in which the actors and their states are included in the database. If you wish to browse all the starting actors, set the filter to Tracking = TRUE in the Filter Criteria section of the Biography Filter dialog box..

In the "Filter Description" box you may change the textual description of the filter you have chosen. It will appear on the bottom of the BioBrowser screen.

In the example below, all person actors whose dominant state is True were selected for browsing. This is a logical state whose value is either True or False for the actor's lifetime. Since the **demo(trk).mdb** file was created with only 20 cases, all 20 actors will meet this criteria.

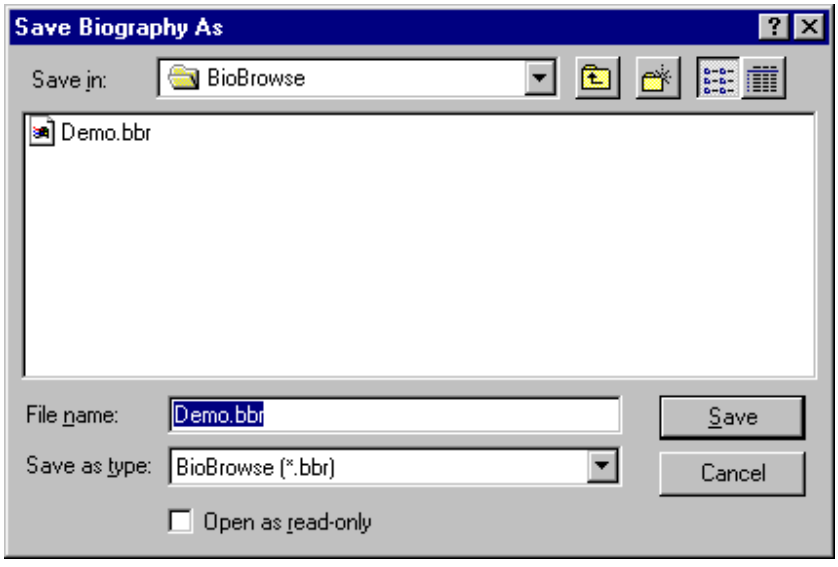


The new biography contains only one display band, the navigation band for the filter tracking state. It indicates the dates in which the actor's state characteristics were captured by the model (the axis at the bottom of the screen indicates the start and end dates). The display band does not have to be continuous. On the top of this display band the number of actors which satisfied the filter criteria is displayed as well as which actor is presently being shown on the screen. In the example below, the first actor out of the twenty which were filtered is being displayed. A later section, "State Selection and Navigation" on page 12, will explain how more states can be added to the biography.



Saving a Biography: The File/Save and File/Save As… Commands

Once all desired states have been added (formatted for style and colour), you may optionally save the biography to file. These files have extension **.bbr** and may be retrieved at a later time against a compatible data base. For compatibility, the filter query must be non-empty and all previously selected actor/state pairs must exist in the open database. All style, colour and navigation positions are saved.



If you have altered the state data within a biography, the window caption will display an asterisk (*) after the file name until you save the biography. This visual asterisk cue is not set, however, by navigation or by changes to global biography options.

State Selection and Navigation

State Selection

Once a biography is created, you may modify and enhance it by adding display bands for different states. You may add display bands of the states for the filtered-in actors (e.g. their earnings). You may also add display bands for linked actors (e.g. their spouses) as well as for the states of these linked actors (e.g. the educational status of the spouses).

The following set of buttons is used for state selection and navigation:

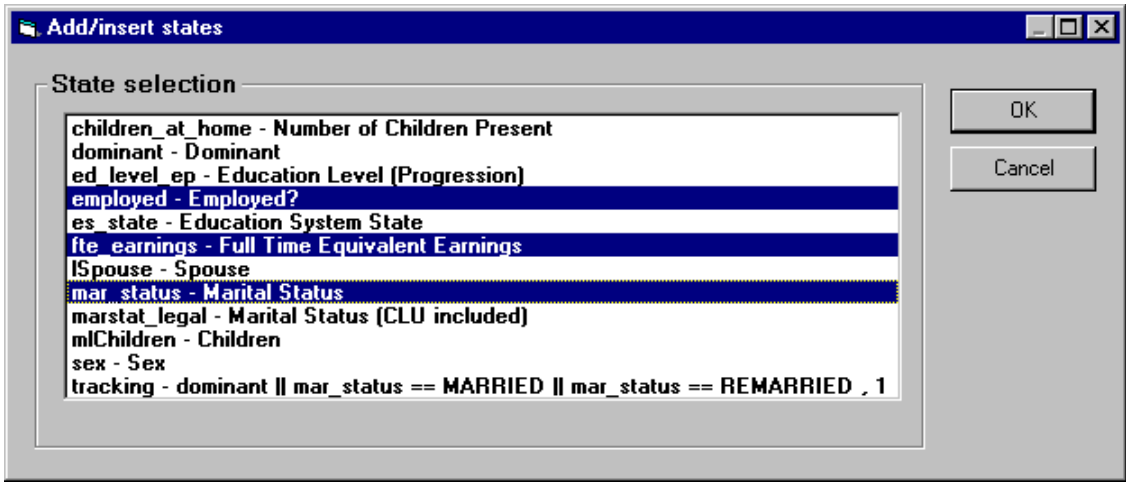
In order: **Add**, **First**, **Previous**, **Next** and **Last**

Add more states by using the **Add** button shown above and displayed to the right of the chart area. States added using the button are always added to the bottom of the chart area. However, for more functionality, use the pop-up menus over the chart area. These menus allow both insertion and deletion of states anywhere on the screen. Insertion will insert the state **after** the clicked position. Deletion will delete the state at the clicked position without notification unless an actor band is deleted with dependent states below it. In this case, BioBrowser will issue a warning indicating how many states will be deleted and provide an option to ignore the delete. The filter tracking band cannot be deleted.

You may add any number of states, any number of times, subject to the limitations of your monitor. The states can be added in any order subject to maintaining the visual hierarchy of the link bands. In this case, the Add button for that band will be disabled. The arrows indicate the indentation in the hierarchy.

Edit/Undo Last Add can be used to repeatedly delete any number of states from the bottom up. To automate navigation of the filtered-in actors (the topmost display band), use the **Timer** command from the Tools Menu, which will navigate through each actor automatically. To go to a specific object in the filter band, use the **GoTo** command in the Browse Menu. All state selections and the current positions of navigation bands are saved with **File/Save**.

Here is an example of the **Add/insert states** dialog box for the demo file supplied with this application. In this case, the Add button from the top navigation band was clicked, showing the states for the person actor. Use extended selection to select/unselect more than one state i.e. Ctrl-Click to select/unselect states, Shift-Click to select a range of states. Press the OK button when your selection is complete.



Note above, that the description of the tracking state contains the tracking condition for this actor used at database creation time. In this case, non-dominant persons (spouses) are tracked only when their marital status is married or remarried.

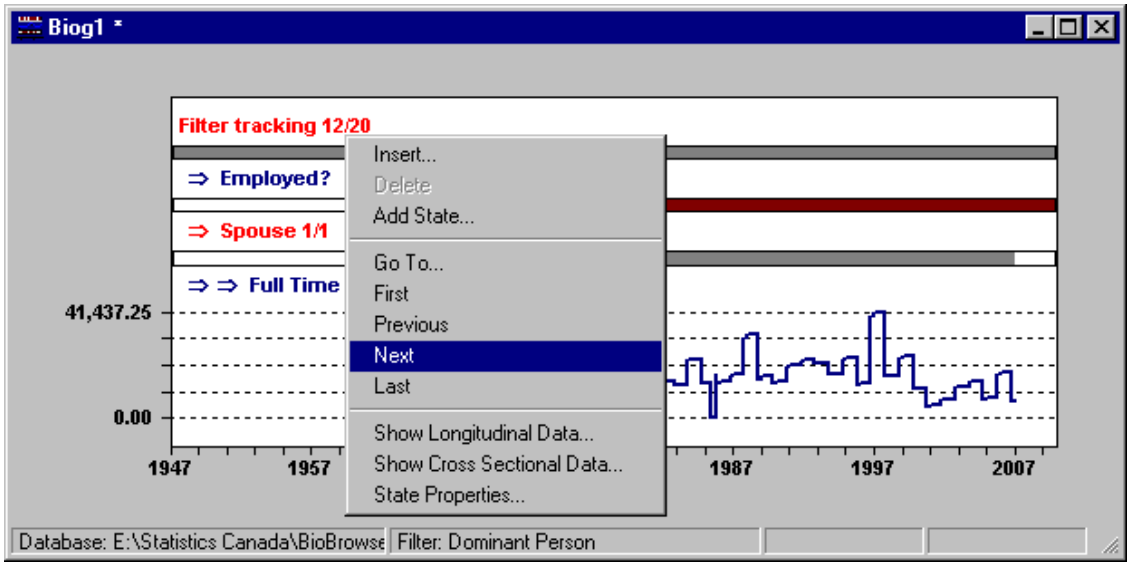
State Navigation

Navigate by using the **First**, **Previous**, **Next**, and **Last** buttons shown above or by using a pop-up menu over a navigation band. The pop-up menu has the additional functionality of a "Go To" command.

The first navigation band always refers to the filter query. If you add a linked actor, a new navigation band is created by BioBrowser. This band differs from the topmost band in several ways. First, unlike the topmost display band which shows the tracking state for the filtered-in actors, those for the linked actors graphically display the time frame in which the related actors are linked to the filtered-in actors (as opposed to when the related actors were tracked by Modgen). If you wish to see the tracking state, then you may add it as a separate display band.

Secondly, for linked actors, you are permitted to navigate beyond the total count for the current set of actors within the band. This is useful when adding the same link more than once. For example, a person actor may be linked to multiple child actors. This actor may have 0 to 6 children. If you wish to see certain states for the first 2 children within the same biography window, add the *link to child* state twice and position the navigation bands at 1 and 2 respectively. These positions are retained as you navigate from person to person. If the current person-actor has no children, this navigation will still work although the bands will show (1/0) and (2/0) and no states will be displayed. In this case, the **First** button will go to 1/0, the **Last** button will have no effect on the position.

With small screen resolutions, you may choose to hide the navigation bands and use the pop-up menus for movement. This is illustrated below.

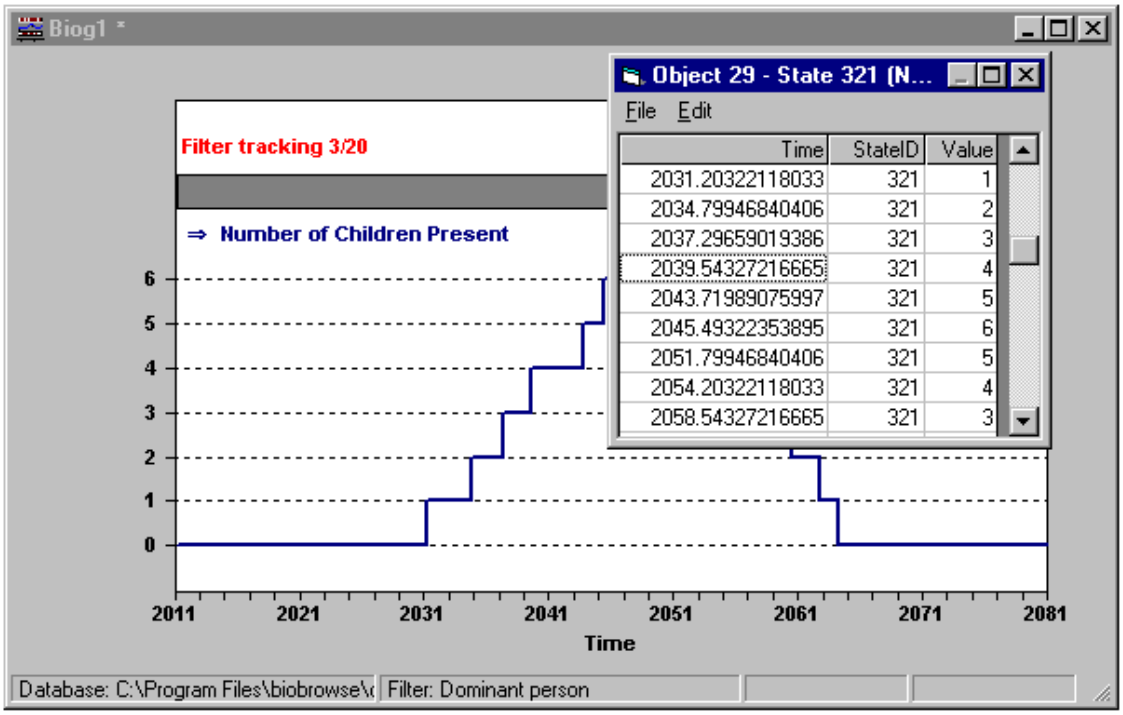


Alternate keyboard navigation is available for the top filter band. The **Filter/Browse** menu contains a Go To and the four movements with optional Ctrl key equivalents: **Ctrl+G** for GoTo, **Ctrl+Q** for First, **Ctrl+W** for Previous, **Ctrl+E** for Next and **Ctrl+R** for Last.

Browsing and Changing the Underlying Chart Data

Browsing the Data Longitudinally

To browse the actual data underlying a specific state in the chart, use the **Show Longitudinal Data** command in the state pop-up menu. This command will open a window showing exact times and values used to plot the data. It typically contains values of two states, the tracking state and the actual state selected. The highlighted cell in the Time column of the grid will be the closest time of lesser or equal value to the X axis position of the mouse when the window was opened.

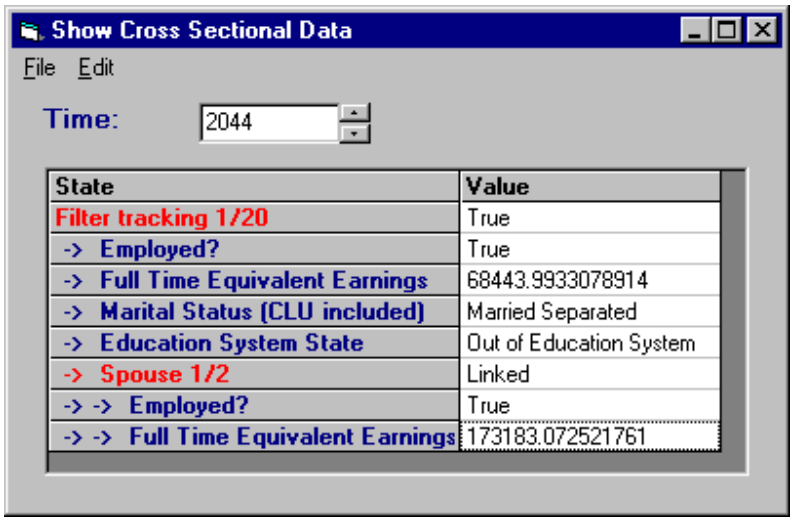


Copy any selected block of this data to the clipboard using **Edit/Copy** or **Ctrl+C**. To select an entire column, click its header tile. To select all data within the window, click and drag across all header tiles.

The **Show Longitudinal Data** window contains a subset of records from the **History** table of the database file. Advanced users may wish to use the object identifier shown in the caption (optionally with the state identifier, also shown there) to open the database file directly with MS Access and perform further analysis in that environment.

Browsing the Data Cross Sectionally

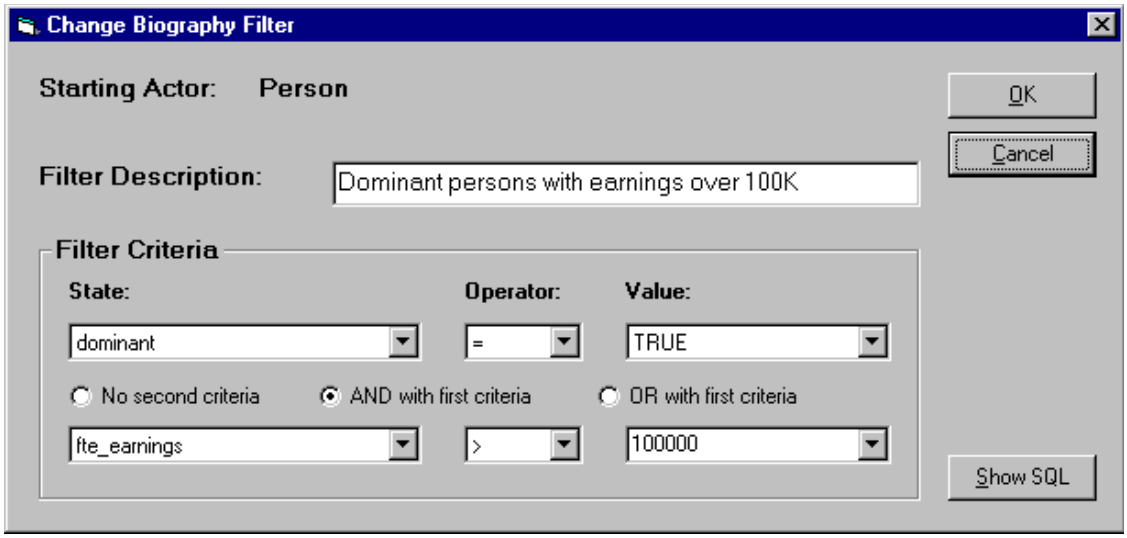
To browse the chart data for all states at a specific point in time, use the **Show Cross Sectional Data** command in the state pop-up menu. This command will open a window showing state values for all selected states at the point in time on the X axis where the mouse was clicked.



Changing the Biography Filter

Once the biography is open, use menu item **Filter/Criteria** to change both the biography filter and its description. If the filter is changed and the resulting query is not empty, the biography filter tracking band is reset to position 1. Use menu item **Filter/Description…** to change only the filter description without affecting the position of the filter tracking band.

You may choose either 1 or 2 conditions for the criteria, both containing a state, operator and value combination. In the case of one condition, select the 'No second criteria' option within the Filter Criteria frame. In the case of two conditions, choose either the 'And with first criteria' option or the 'Or with first criteria' option. The **And** criteria will be met if both conditions are satisfied ***at any time in the actor's lifetime***. Note very well that the conditions do not have to be met simultaneously (over the same period of time). The **Or** criteria will be met if either condition is satisfied at any time in the actor's lifetime.

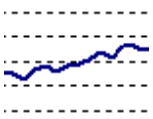
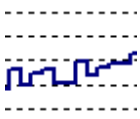
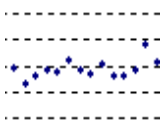


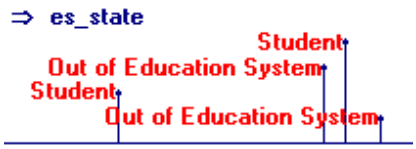
The above filter demonstrates the use of an **And** condition. In this case, the person actor must be dominant (a state which is either True or False at birth and never changes) **and** earnings must have exceeded $100,000 at any time in that person's lifetime.

Display and Output Options

Formatting the Chart Area

When a state is added various defaults for chart presentation are used depending on its Modgen state type. At present, five chart types are permitted:

Line	Level	Horizontal Bar	Point
			

Event


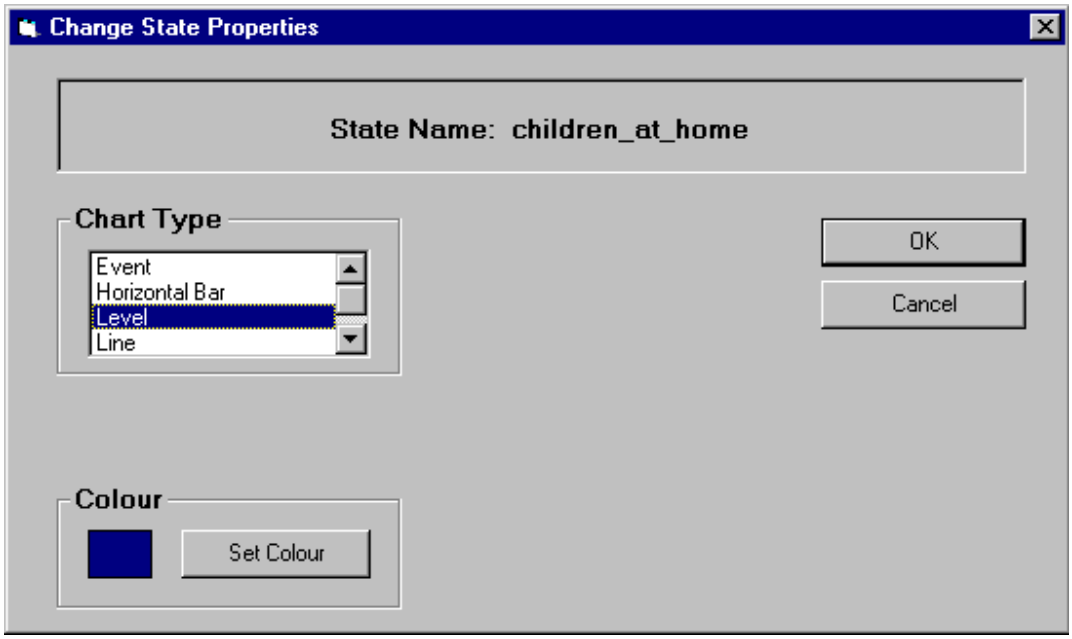
BioBrowser recognizes the following Modgen state types and plots them by default according to their state type:

State Type	Default Chart Type
Integer	Level
Long	Level
Floating Point	Line
Double	Line
Time	Line
Logical	Horizontal Bar
Classification	Event
Range	Level

The **Line** style draws one line between 2 adjacent points, whereas the **Level** style draws two lines (a vertical then a horizontal) between 2 points. The **Horizontal Bar**, although most appropriate for logical, classification and range type of Modgen states can be used on all states. For continuous states such as float or double, the horizontal bar uses colour interpolation from a start and end colour defined by the user. No legend is available for **Horizontal Bar**.

The default colour for **Line**, **Level** and **Point** plots is blue. The default colours for **Horizontal Bar** are white and gray. You can control the line thickness, band width and point size for the biography but not at the level of a single state. At present, these settings are global to the biography window. All such settings are saved with the biography.

Double-click on a chart within a biography, or right click on it and select State Properties from the pop-up menu, to re-format it for chart type and colour. A format string for the Y-Axis labels where appropriate can be changed at this time as well. The following dialog box is used to set or adjust these properties:



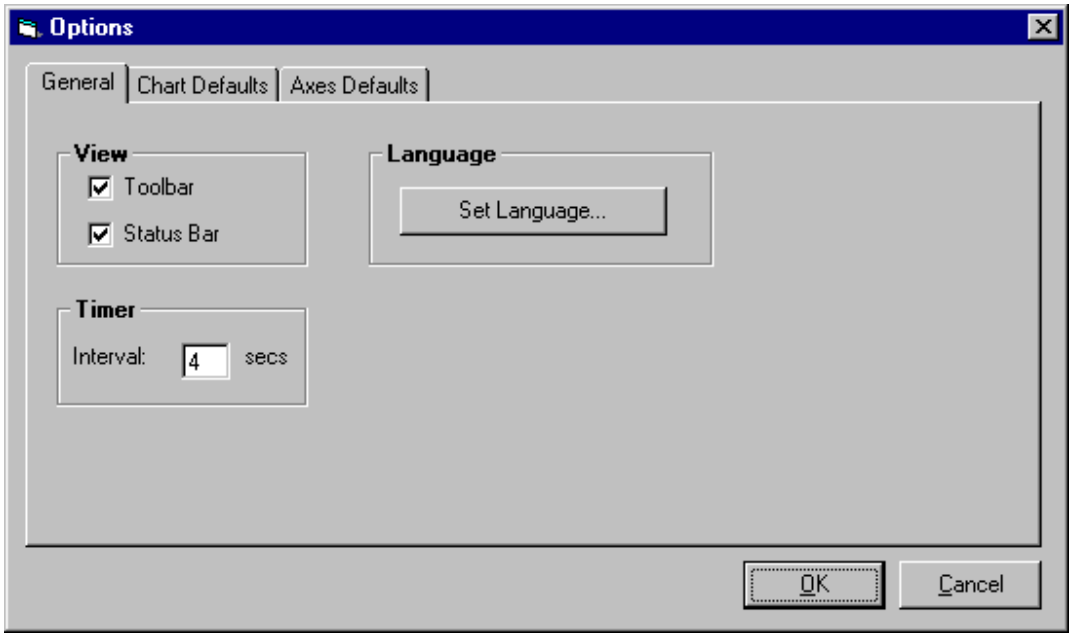
If the chart type selected is **Horizontal Bar** a second colour will be presented for selection. For logical states, these will be the False and True colours. For all other states types these will be used as a start colour and end colour in a colour interpolation process.

Setting and Saving Display Options

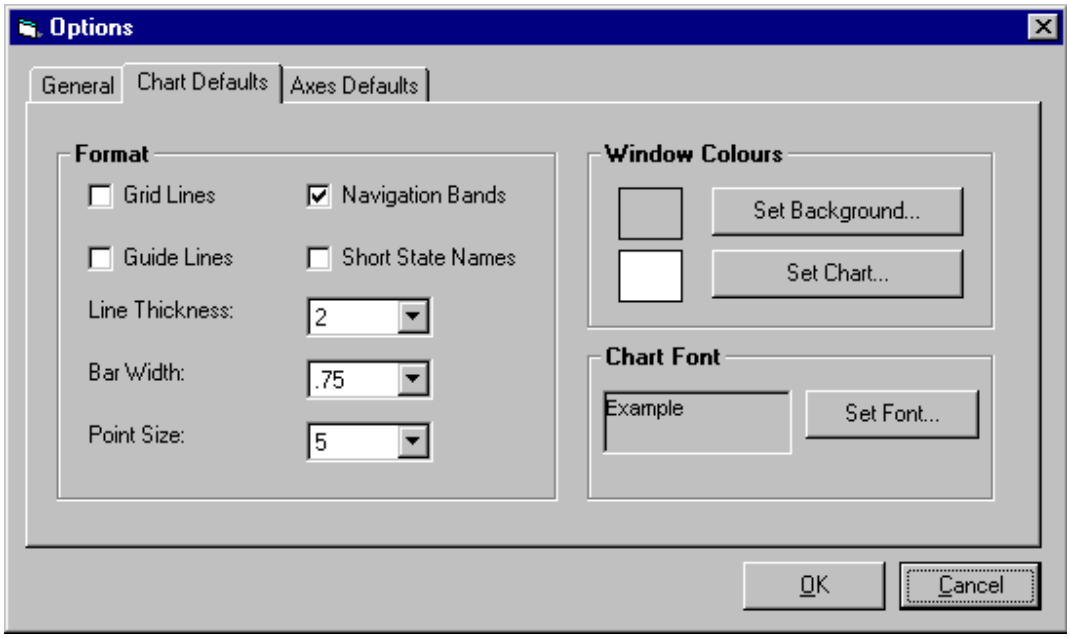
Use the **Format** menu commands to change display options for the active biography window. The **View** menu, which includes the ToolBar and Status Bar display options, are application global.

The **Tools/Options** menu can be used to set and save session defaults and display default options for new biographies. The Options dialog box consists of three tabs: General, Chart Defaults and Axes Defaults. The General options will take effect immediately, whereas the two Default tabs are used only with new biography creation. The OK button will save these defaults to your application ini file.

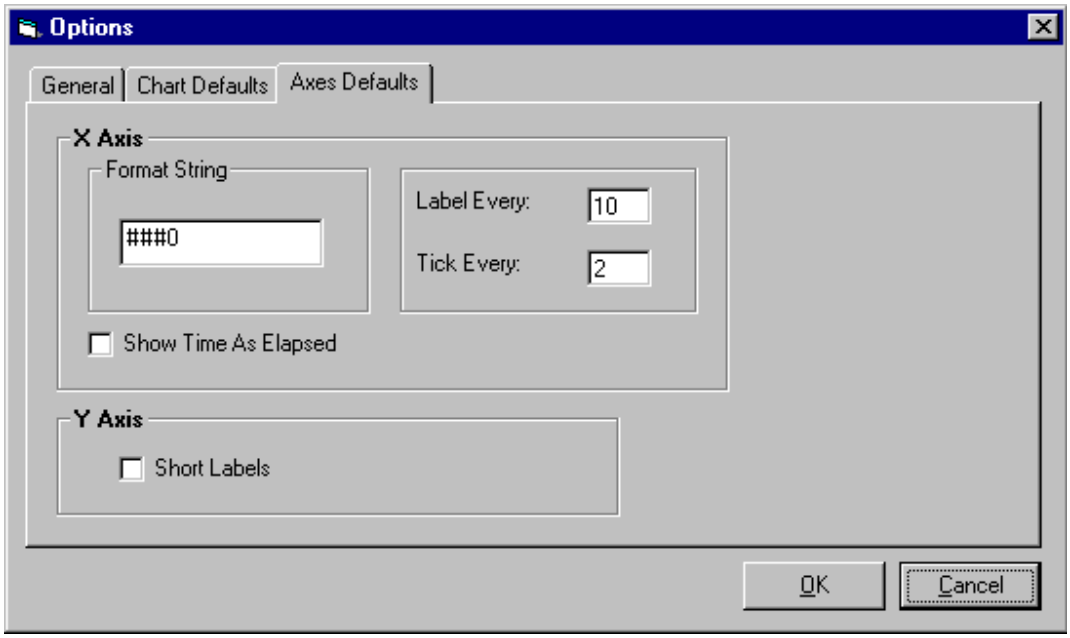
The General tab below sets and saves session defaults used at application startup. To change them during the session, use the **View** and **Tools** menus.



The chart defaults used for new biography creation consists of the following display options. To change these options for an already open biography, use the **Format** menu.



Axes defaults for new biography creation are set and saved within the third options tab. Axes properties for an open biography can be set by double clicking the axes area of the chart window or by using the **Axes Properties** command from the **Format** menu.



Note that all display options and axes properties currently in effect for the open biography are saved with the biography file.

Sending a Biography to the Printer or Clipboard

To print a biography, use **File/Print** or the Print button on the toolbar.

The printed biographies are sized to fit the page while maintaining their aspect ratio. The orientation used will depend on the aspect ratio of the biography window being printed, i.e., if the window is wider than tall, landscape will be used.

To send a biography to the clipboard, use **Edit/Copy,** Ctrl-C or the Toolbar copy button.

Appendix: Creating a New Modgen Database File

Overview

If you want to make a biography using different actors and/or states, you will need to create a new database using Modgen. The creation of the database file occurs with the execution of a Modgen simulation model and, therefore, requires some knowledge of the Modgen simulation environment. The name, location, and contents of this special file are controlled as follows:

- the filename, its location within the directory structure, and the number of simulated lifetimes contained within the database file are defined through a Modgen scenario and its Scenario Settings dialog box. Modgen manages model run outputs by using the scenario name followed by a bracketed identifier indicating the type of Modgen output and an extension indicating the type of file. For tracking outputs, the convention used is: scenario_name(trk).mdb.
- the set of actor/states to be displayed by BioBrowser must first be listed in the model variable tracking facility within the Modgen source code for the specific simulation model. This set including the tracking filter for each actor are required by the model at compile time and can not be dynamically set at run time.

Scenario Settings

There are a variety of Modgen scenario settings which determine the nature of each specific simulation. The scenario settings are discussed in complete detail in the Modgen User's Guide. However, there are three main settings which must be understood in order to create an appropriate database file for the Biographical Browser.

- In the **Scenario/Settings/General** tab, select "MS Access tracking". This setting tells Modgen that, in addition to the other outputs specified, a tracking database file is requested as output for this model run.
- **For case based models**, select the number of cases in the Scenario/Settings/General tab. As a general rule, it is important to specify a small number here since all of the simulated cases which meet the tracking filter will be included in the database file. The size of this file can become very large, very quickly depending on the number of cases and states included. In addition, variable tracking will slow the simulation down considerably.
- **For time based models**, select the time-units in the Scenario/Settings/General tab.

The demonstration file accompanying this release, **demo(trk).mdb**, contains 20 cases (which for this model corresponds to 20 simulated lifetimes of a person actor whose dominant state is True). It was created from the Statistics Canada model, LifePaths.

Modgen Model State Tracking

The tracking facility provided by the Modgen language controls the type of actors to be included in the database file along with the list of states which are to be analyzed with BioBrowser.

The track command must be included in one of the .mpp files which contain the Modgen model code which define the simulation model. If the analyst wishes to change the type of actors to be tracked, or change the complement of the states to be output, then the Model must be re-compiled. This is discussed further in the Modgen Developer's Guide. This guide should also be consulted by readers who are unfamiliar with the concepts outlined in the syntax and examples which follow.

Syntax of the Track Command

track actor_name [filter] { state_or_link , ... , state_or_link } ;

It is important to remember that only one track definition is allowed for each actor in the model. In addition, the filter specifies if and when an actor's states or links are to be output to the database file.

Example

In this example, the states which describe the person are only output to the database file when he/she is married or remarried (the dominant characteristic is discussed in the Modgen Developer's Guide). Therefore, if the person was married at age 25, divorced at age 40, and re-married at age 50, then the database file would only contain information on this person from the ages of 25 through 40; and 50 to the age at death. There are nine states which describe the characteristics of the individuals stored in the database file. The last two items of the track definition are not variables but links to other individuals associated with this person. In this case, the database will contain information on the nine variables defined in the track command on the person's spouse and children if they are present.

```
track Person
[ dominant || mar_status == MARRIED || mar_status == REMARRIED ]
{
      es_state,
      ed_level_ep,
      sex,
      dominant,
      employed,
      mar_status,
      marstat_legal,
      fte_earnings,
      children_at_home,
      lSpouse,
      mlChildren
};
```

Example

In this example the date of birth and sex states for a child actor are output to the database file once the child is established in a family (the tentative characteristic is discussed in the Modgen Developer's Guide.

```
track Child [ !tentative ]
{
      date_of_birth,
      sex,
      mlParents
};
```

Contents of the Database File

The MS Access file produced by a Modgen simulation contains a data table called **History** and the following dictionaries organized hierarchically:

ActorDic - actor dictionary.
ActorStateDic - tracked state dictionary.
ActorLinkDic – tracked linked actor dictionary.
TypeDic - state type dictionary containing a pointer to a specific dictionary below.

The dictionaries for each state type are as follows:

SimpleTypeDic - for simple state types e.g. integer, double, float.
LogicalDic - for logical states.
ClassificationDic and ClassificationValueDic - for classification states and their values.
RangeDic - for range type states.
TypeDic - for linked actors.

Any dictionary with textual identifiers will contain 1 record for each language implemented in the specific Modgen model, as indicated by LanguageDic.

In addition, a file version table called VersionInfo will indicate the version of the tracking file. The BioBrowser uses this version to maintain backward compatibility if the tracking database design is changed.

The **History** table contains one record for each tracked state at one point in time. A record is added to this table, each time a tracked state changes for each tracked actor. The History table fields used by BioBrowser are: an object identifier, time, a state identifier, and a value for the given state. The ShowData window contains a subset of records from this table. Since the object identifier is common across all records in the ShowData window, its value is shown in the window caption.