ELEVATED PLUS MAZE

MED-STATE NOTATION^{TM} PROCEDURES

SOF-700RA-3 Manual
DOC-023
Rev. 1.2

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CHAPTER 1
Introduction

The purpose of this manual is to give an explanation of the MED State Notation™ Procedures that comprise the SOF-700RA-3 Elevated Plus Maze Procedures. The files in this package can be found on the disk provided by MED Associates, Inc.

These procedures are intended to be run in MED Associates MED-PC® IV software. The latest version of MED-PC® IV gives researchers the ability to use pre-programmed procedures such as these to make hardware control and data collection easy. These pre-programmed procedures can also be modified to meet the evolving demands of a research protocol. Again, it is the intent of this manual to explain exactly what these procedures implement, and provide guidance into how to interpret what the program code achieves in order to let the user determine how to modify them to match their research protocol demands. The manual provides some examples of editing and modifying the procedure's programming code. The manual also defines the elements in the raw data file produced by these procedures.

In addition to this manual, refer to the **MED-PC® IV User's Manual** for the installation of the MED-Associates interface drivers, the MED-PC IV Software, and the Delphi® Compiler. Also refer to the User's Manual for instructions on developing a Hardware Configuration. Data file structure, file-saving format, and other related options are also determined by the Hardware Configuration. Running the Hardware Configuration software utility that accompanies MED-PC IV sets the Hardware Configuration. Its purpose is to assign the inputs and outputs on the interface cards in the interface cabinet for each task controlled by MED-PC IV. The particular type of interface card that is supplied in the interface cabinet may vary; please refer to the User's Manual provided for instructions on how to configure the type of card that is in the cabinet. A valid Hardware Configuration must exist in order for MED-PC IV to interface correctly with the MED Associates, Inc. hardware. This means that one should take the time to create a valid Hardware Configuration before attempting to run the procedures included in this package.

Should there be any problems, the staff at MED Associates, Inc. is available to answer any questions that may arise. Please e-mail us at support@med-associates.com with a detailed description of the problem or desired goals so that concise and detailed information may be provided.

The Elevated Plus Maze procedures are designed to be as easy to use as possible. MED Associates, Inc. understands that researchers do not have the time to devote to programming and hardware design, and for that reason, we have undertaken that burden for you. We sincerely hope that you are satisfied with the products and services we provide, and look forward to meeting your future experimental needs as your research program evolves.

Thank you for purchasing the Elevated Plus Maze Data Collection Application.

Overview of the Procedures

Elevated Plus Maze 1.mpc

The **Elevated Plus Maze 1.mpc** procedure begins by placing the subject in the junction of the open and closed runways. Two infrared (I/R) photobeams are positioned at the entrance of each of the four runways of the maze and are used to track the subject as it explores each runway of the maze.   Runway time is counted when the animal starts exploring the runway.

Elevated Plus Maze 2.mpc

The **Elevated Plus Maze 2.mpc** program is very similar to Elevated Plus Maze 1.mpc. The only difference between these two programs is that Elevated Plus Maze 2 requires the subject to clear both I/R photobeams before "Runway Time" is counted. Therefore, the Elevated Plus Maze 2.mpc program tabulates a much more conservative measure of Runway Time.

Both programs require that the MED-PC IV resolution to be set to 2 ms or less (see the **Setting the Temporal Resolution** section of this manual).

Figure 1.1 - Overview of the Plus Maze
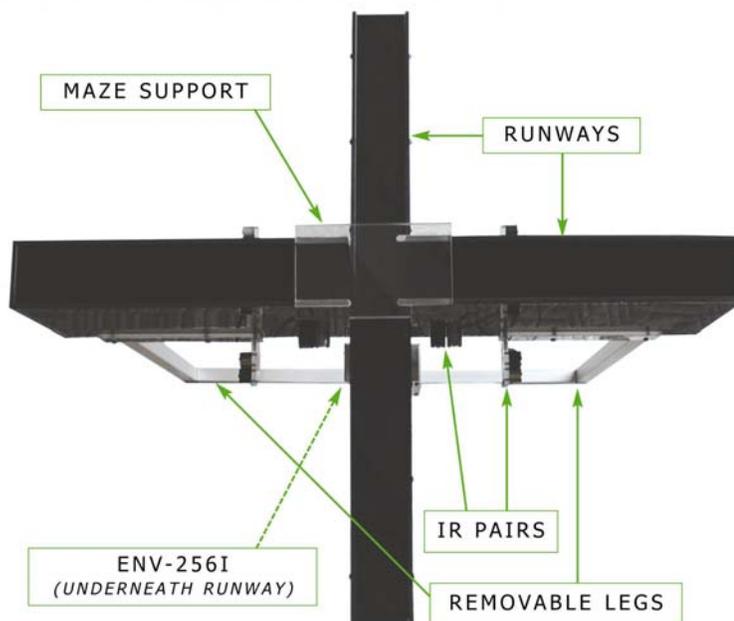
Dependent Variables

Entrances

When the subject moves completely into a runway of the maze, it is recorded as an **entrance**. For an entrance to be recorded by the program, the subject must break and then release both I/R photobeams (located at the entrance to each runway) in succession. Once an entrance is recorded, the program assumes that the subject remains on the runway until returning to the junction area, and the time spent in that runway is tabulated.

Figure 1.2 - Entrance Diagram
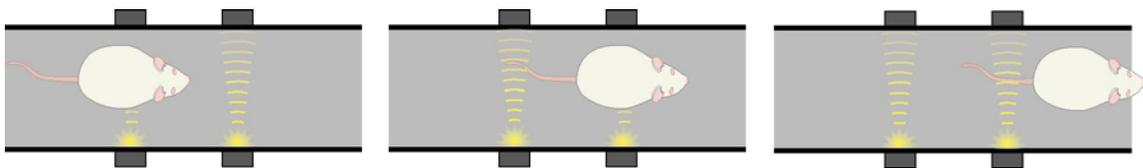
Explorations

An **exploration** is the event that occurs when the subject moves partially into one runway of the maze, and then retreats back into the junction area. In order for an exploration to be recorded, the subject must break one or both I/R photobeams located at the entrance of a runway and then retreat, thereby releasing the outermost I/R photobeam first. If an exploration is recorded, then the program assumes that the animal has returned to the junction.

Figure 1.3 - Exploration Diagram, One Beam Broken
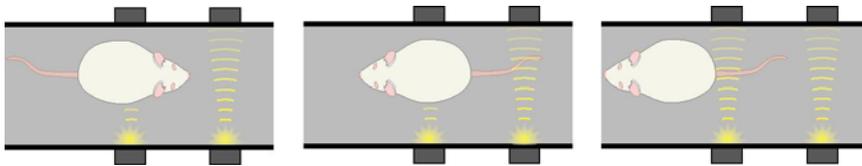
Figure 1.4 - Exploration Diagram, Two Beams Broken
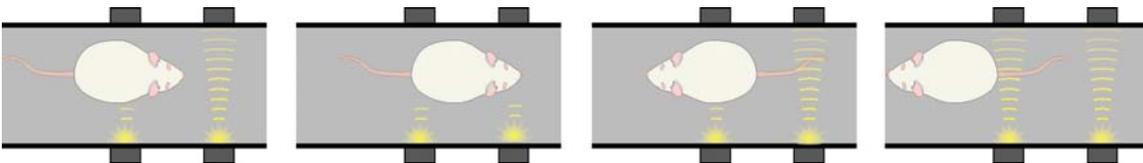
Runway Time

For the Elevated Plus Maze 1.mpc program, the amount of time the subject spends in each of the four runways is tallied once the I/R photobeam most proximal to the junction is interrupted. In the data file, runway time is displayed in seconds.

Junction Time

Junction time is calculated by the program and represents the total amount of time spent in the junction area of the maze.

Independent, User-Defined Variables

Session Time

The default Session Time is 15 minutes, but this is a user-defined independent variable, and the value for this variable is set in minutes.

Start Delay

Start Delay is a function that gives the researcher time to start the program and then place the animal into the junction of the plus maze. The session timer and data collection begin as soon as the start delay expires. The default Start Delay is 5 seconds, and this variable is set in seconds.

CHAPTER 2
Getting Started

Software Installation

Please refer to the **MED-PC IV User's Manual** for a complete guide to installing the MED-PC IV software, building a valid Hardware configuration with the Hardware Configuration utility, and opening and compiling a MSN procedure in the Trans-IV utility.

To install the Elevated Plus Maze Procedures, insert the CD into the CD-ROM drive and click **Install the Elevated Plus Maze Software**. The Elevated Plus Maze procedures are copied into the C:\MED-PC IV\MPC folder.

Backing Up the Software

Med Associates strongly encourages creating backup copies of the programs in case of disk failure. Having copies of the original programs may be useful in the future should modifications be made to the existing programs.

CHAPTER 3

Beginning & Running an Experiment

Translating The MED-PC IV (.mpc) File

Programs written in MedState Notation must be translated using Trans IV before they can be executed in this application. Be sure that a copy of the file being translated is present in the directory "C:\MED-PC IV\MPC\." Open Trans IV icon and select **Translation** | **Translate and Compile**.

Select the program(s) to use for the experiment and click **Make**. Click **OK** to start the translator, and it will automatically parse the MedState Notation and then open to a DOS screen to compile the Pascal code. Depending on the speed of the computer, each of these steps may not be seen. If any problems are encountered during this process, refer to the on-screen help menu or the **MED-PC Version IV User's Manual**, or contact MED Associates, Inc. for assistance.

Figure 3.1 - Trans IV Control Panel for Translating and Compiling MedState Notation Code
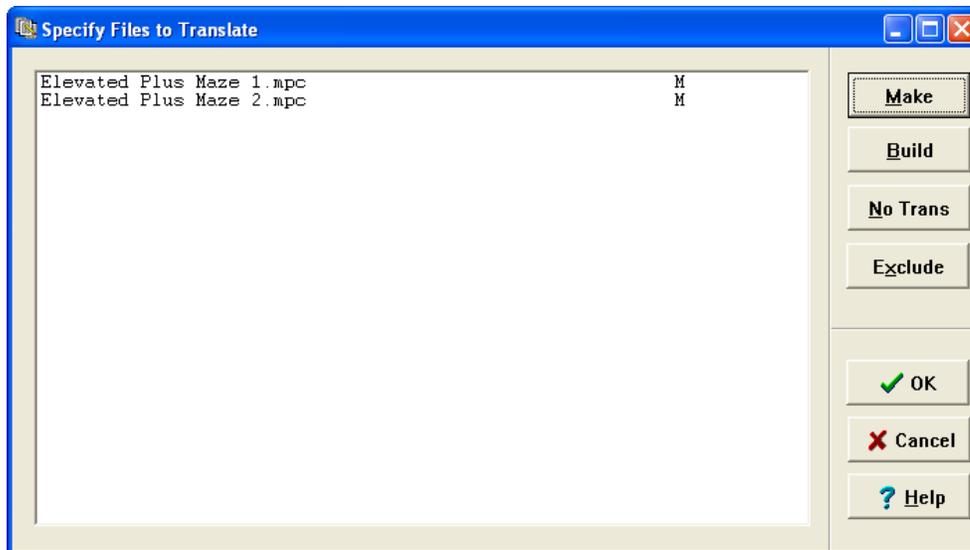
Setting the Temporal Resolution

When running this application, the temporal resolution setting in MED-PC IV should be changed from 10ms to 2ms or less. Failing to do so may result in errors when running this program. Open the Hardware Configuration Utility by clicking **Start** | **Programs** | **Med Associates** | **MED-PC IV** | **Hardware Configuration Utility**. Then click **Define** | **Temporal Resolution**. Set the resolution to 2 then click **OK** and close the Hardware Configuration Utility.

Using the MED-PC IV Load Wizard

MED-PC IV is designed to help the researcher run an experiment by guiding selection choices through its Experiment Loading Wizard. This section will describe how to initiate the Elevated Plus Maze 1.mpc application, however the following steps that will also apply to all other .mpc procedures.

Open MED-PC IV and the MED-PC Experiment Loading Wizard's Welcome screen, shown in Figure 3.2 will appear.

Figure 3.2 - The MED-PC IV Loading Wizard Welcome Screen

To avoid this load wizard, deselect the checkbox labeled **Run this experiment automatically when starting MED-PC**. Close this screen by clicking the **Close** button. Closing this screen immediately reveals the MED-PC Run-Time Screen shown in Figure 3.9. If the choice to continue with the Loading Wizard is made, then click the **Next** button.

The Box Selection screen will appear next, as shown in Figure 3.3. From this screen the researcher chooses which boxes will be used in the experiment. Select the boxes that will run the experiment by clicking in the radio button next to the box number. The figure shows that the Hardware Configuration included only 1 box, which was selected. Click **Next** to continue.

Figure 3.3 - The Box Selection Screen

The Select a Procedure screen appears next, as seen in Figure 3.4. This is where the application to be run is selected. The screen displays a list of all the currently compiled procedures. Select the desired procedure and then click **Next**.

Figure 3.4 - The Select a Procedure Screen

The Enter Experiment Data Screen should display next, as shown in Figure 3.5. The purpose of this screen is to allow annotations to be added to the data file that is produced by MED-PC IV. These annotations will help identify the Subject, Experiment, and Experiment Group upon which data was collected. Comments can be added here as well, and the data file can be given a customized file name to help identify it from other data files. Enter the information desired, and click **Next**.

Figure 3.5 - Enter Experiment Data Screen

The next screen to appear is the Review Choices screen, as seen in Figure 3.6. This is a method of confirming that the information received from the Box/Procedure Selected is correct. If it is not correct, select **Previous**, and edit the data. If it is correct, select **Next**.

Figure 3.6 - Review Choices Screen

The Alter Session Parameters Screen, shown in Figure 3.7, is the next screen to appear, and is an important screen for the researcher. The Alter Session Parameters screen allows the researcher to alter the parameters by which a procedure executes. The Send Start Command Screen appears next. The options available on the screen vary depending upon how many boxes are described in the Hardware Configuration.

Figure 3.7 - Alter Session Parameters Screen
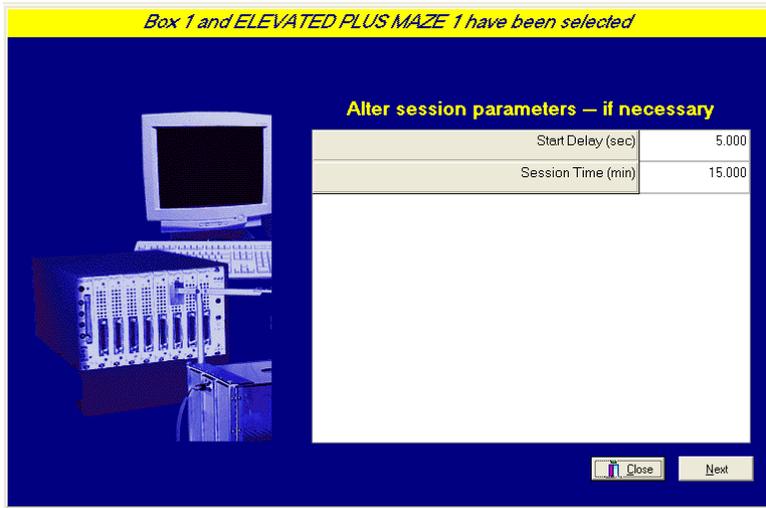
In this example only 1 box is described in the Hardware Configuration, so Figure 3.8 will appear next. If more than 1 box is in the Hardware Configuration, then Figure 3.9 will appear.

Figure 3.8 - Send Start Command Screen for Single Box Configuration
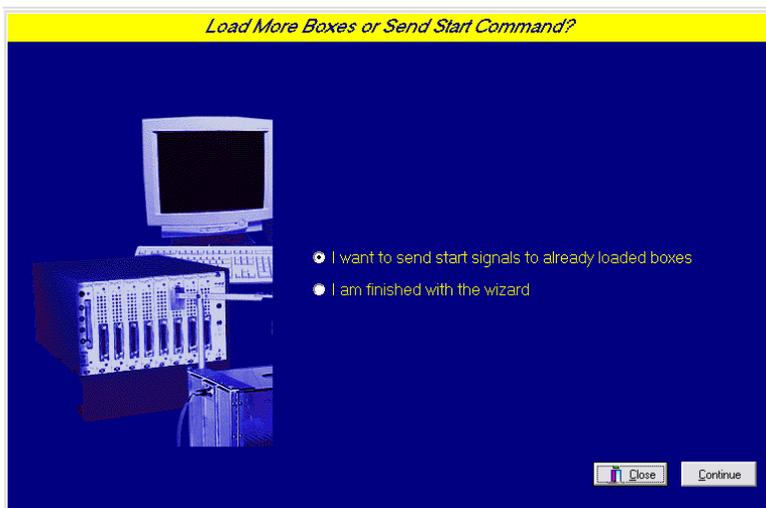
Figure 3.9 - Send Start Command Screen for Multiple Box Configuration
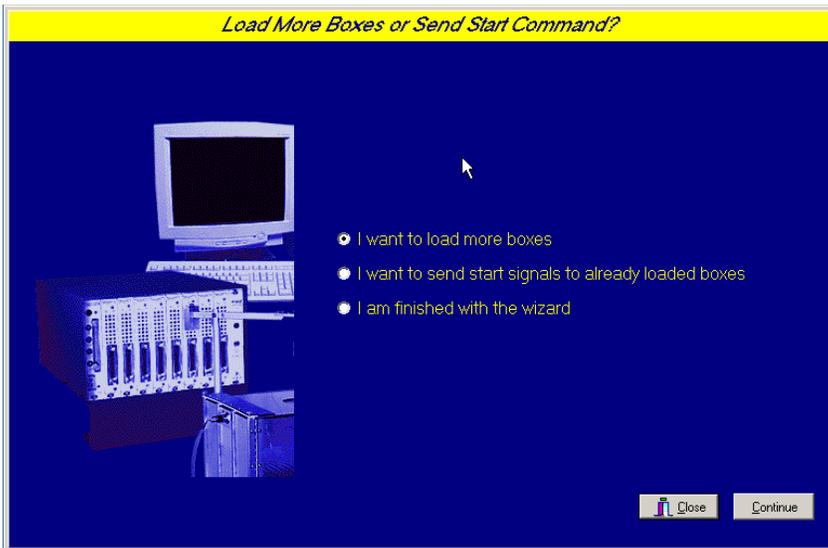
In both cases (Figure 3.8 and Figure 3.9), the screens are where the researcher decides to either load more boxes, send a start signal to boxes that are already loaded, or enter the MED-PC IV run-time environment without sending a start signal by selecting "I am finished with the wizard". This option results in the screen shown in Figure 3.10.

Figure 3.10 - The MED-PC IV Run-Time Screen
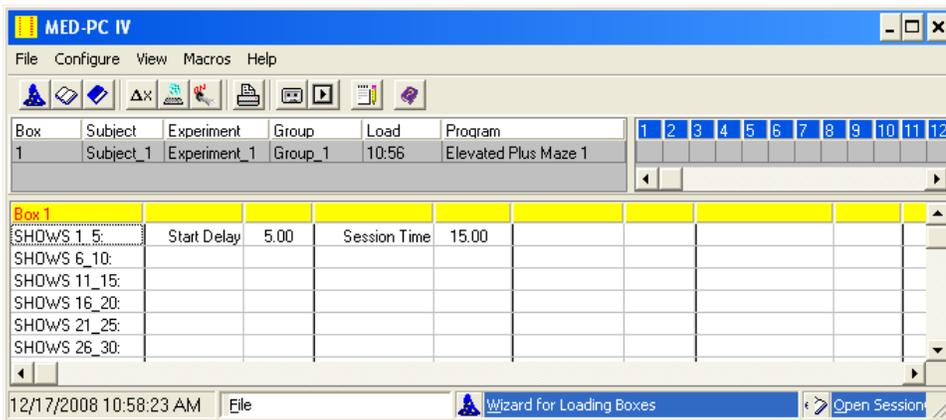
Viewing/Changing Variable Values

Before a "start command" has been issued, any variable may be changed on the MED-PC IV run-time screen. Simply highlight the value to change, and then enter the new value. Once a session is in progress, change variables by selecting **Configure | Change Variables**, or click the 4th tool bar item **ΔX**. In the lower left hand corner of the Change Variables window, find the "Display Data from Box" display, and choose the chamber(s) to modify.   By clicking additional boxes in the "Additional Boxes to Update" section, changes made to a single box are automatically loaded to all of the selected boxes.

Figure 3.11 - Changing Variables Screen
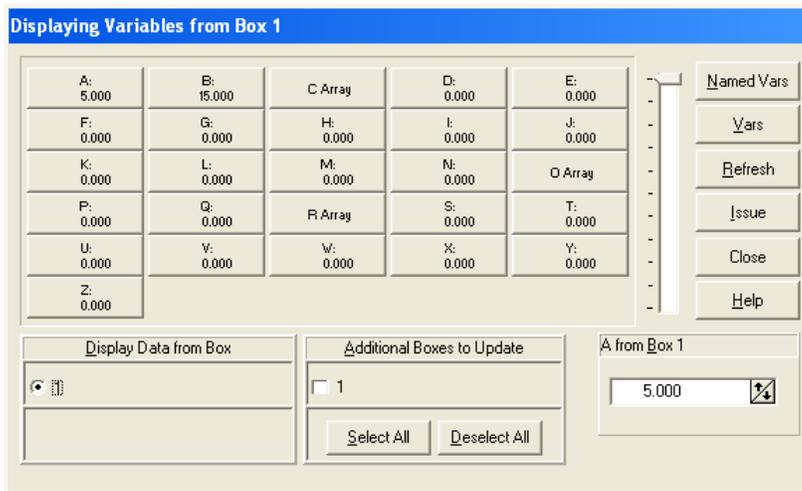
To change a value, simply highlight and replace the value in the lower right hand box or use the up/down arrows to increment by 1. Click the **Issue** button for the change to take effect. Click **Named Variables** to produce the display in Figure 3.12. Change variables here as needed.

Figure 3.12 - Displaying Named Variables from Box 1
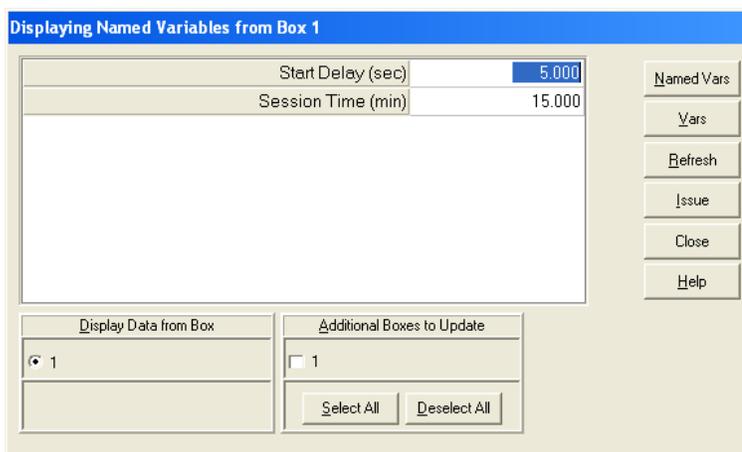
Macros

The simplest way to initially create a macro is to record keyboard functions while performing the steps manually. Once the commands are in the macro, it is easy to create a number of macros with the macro editor. The following example illustrates the process of loading "Box 1" and changing the Session Time to 30 minutes.

To begin, open MED-PC IV and going directly to the run time screen. Close the load wizard, if present. Before loading or opening the procedure, click **Macro** on the main menu and select **Turn On Macro Recorder** or click the 8th tool bar item with the cassette tape icon on top. A note on the bottom of the display indicates that the recorder is running. Open "Elevated Plus Maze 1.mpc" by clicking **Files | Open Session**. Change the variables using any of the methods described above. When all settings have been made, turn the recorder off again by using the main menu or tool bar. Save the macro with a distinctive name. The example in Figure 3.13 was named "EPM_SessionTime_30.mac" since the Session Time was changed to 30.

Figure 3.13 – EPM_SessionTime_30.mac
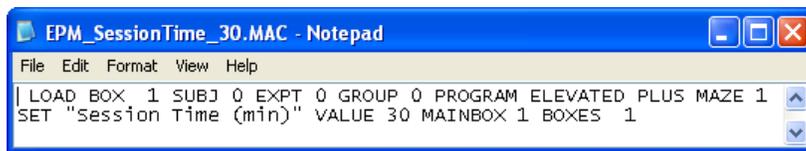
Once this macro is built, use the macro editor to make simple changes such as replacing reward or correct lever values. Review the Help file on screen or the **MED-PC IV User's Manual** for more information on macros and the features offered. A START command or message box followed by a START command could be added to the macro (it was left off here so changes could be verified before starting the procedure).

Modifying the MedState Notation Code

Permanent changes to the Elevated Plus Maze procedures can be made to the MedState Notation code. To make the same change to the Session Time as shown above, do the following. Open Trans IV and select **File** | **Open** to place Elevated Plus Maze 1.mpc into the text editor. Scroll down to approximately line 97 (note the line counter in the lower right hand corner of the editor) to reveal the code shown in Figure 3.14.

Figure 3.14 – Elevated Plus Maze 1.mpc Line 97
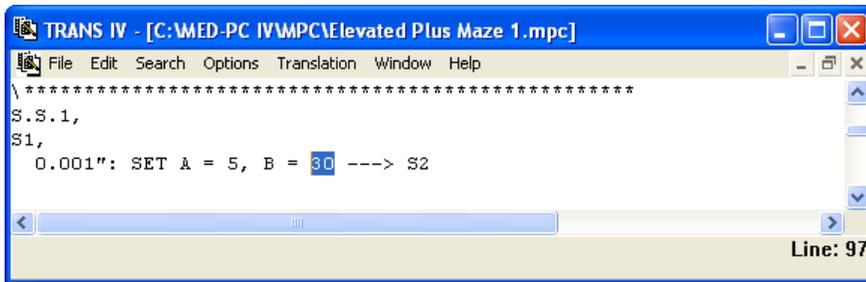
Change B = 15 to B = 30 and save the changes with the same or a new file name such as EPM_SessionTime_30.mpc. Remember, if creating a new .mpc file name and are using a macro to load boxes, the file name in the macro also must be changed. Translate and compile the new or changed file as described previously and run MED-PC IV. Use the "Change Variables" screen to view/confirm the new values.

CHAPTER 4

Understanding the Data Files

Unless otherwise specified, data will be saved to C:\MED-PC IV\DATA. Data can be saved manually by selecting **FILE | SAVE DATA MANUALLY** or **FILE | SAVE DATA (FLUSH)**. The file name that is used to save the data in depends on the option that was chosen in the Hardware Configuration Utility and may also be dependent on the Subject, Experiment, and Group name provided in the MED-PC IV load wizard. Within each data file, the headings are created for each Subject, Experiment, Group, Box, etc., (see below). Data files may be opened with note pad, word pad, or any word processor or spreadsheet; however, be sure they are always saved "unformatted" in case a data extraction utility such as MED-PC to Excel might ever be used. Data file formats are explained in detail in the **MED-PC IV User's Manual**.

Sample Data File

Select **Annotated** on the file options page during hardware installation to produce a raw data file similar to the following. Data files are located in C:\MED-PC IV\Data\ unless an alternate path was defined during hardware installation. They may be opened with note pad, word pad, or any word processor; however, make sure they are always saved underlined unformatted in the occasion a data extraction utility such as MPC2XL is used. The header information should be self-explanatory. Data-file formats are explained in detail in the **MED-PC IV User's Manual**.

```
File: C:\MED-PC IV\DATA\!2004-04-06_15h40m.Subject 0

Start Date: 04/06/08
End Date: 04/06/08
Subject: 0
Experiment: 0
Group: 0
Box: 1
Start Time: 15:40:24
End Time: 15:43:34
MSN: Elevated Plus Maze 1
A:        5.000
B:       15.000
J:        6.576
S:      180.000
C:
     0:          2.000         2.000          70.122
O:
     0:          2.000         2.000         103.302
R:
     0:          0.000         1.000          1.000         1.000         1.000
     5:          4.000         4.000          8.000
```

Breakdown of Sample File - Simple Variables

The following simple variables are shown immediately following the header information:

```
A:        5.000        Start Delay in seconds
B:       15.000        Session Time in minutes
J:        6.576        Junction Time in seconds
S:      180.000        Elapsed Start Delay and/or Session Time in seconds
```

Breakdown of Sample File - Arrays

The arrays are presented in rows of 5 elements each. The first row begins with element 0 and ends with element 4; the second row begins with element 5 and ends with element 9, etc. Each row begins with an element marker followed by a colon, 0:, 5:, 10:, etc. Size of Array C was set to 2 with the DIM command, which means that Array C was defined for 3 data points. Array O was defined for 3 data points, and array R was defined for 8 data points.

Each array has been defined in the comments section at the beginning of the .mpc file. That information was used to add the following labels to each array. The lines were expanded to make room for the labels.

Array C - Raw Data

Array C is used for closed exploration, closed entrance and time. These values represent the data obtained from the radial arms with the attached walls.

```
C:
    0:        2.000        2.000        70.834
```

Array C with Labels

	C(0)	C(1)	C(2)
Row Marker	Closed Exploration	Closed Entrance	Time in Closed Runways
0:	2	2	70.834

Array O - Raw Data

Array O is used for open exploration, open entrance and time. These values represent the data obtained from the open-sided radial arms.

```
O:
    0:          2.000        2.000      103.302
```

Array O with Labels

	O(0)	O(1)	O(2)
	Open Exploration	Open Entrance	Time in Open Runways
Row Marker			
0:	2	2	103.302

Array R – Raw Data

Array R is used to for total runway data.   Elements 5, 6 and 7 are internal variables that help with the control of the program. Their values are not important.

```
R:
    0:        0.000      1.000      1.000      1.000      1.000
    5:        4.000      4.000      8.000
```

Array R with Labels

	R(0)	R(1)	R(2)	R(3)	R(4)
	Not Used	Full Entrances to Runway 1 (closed)	Full Entrances to Runway 2 (open)	Full Entrance to Runway 3 (closed)	Full Entrance to Runway 4 (open)
Row Marker					
0:	0	1	1	1	1

	R(5)	R(6)	R(7)
	Active Arm	A-Beam	B-Beam
Row Marker			
5:	4	4	8