EQS for Windows 5.7b Supplement
(07/20/98)

EQS **Diagrammer** has undergone significant changes in version 5.7. For those who have not used any drawing tool, **Diagrammer** may be an exciting yet new adventure. There are a few principles we would like to share with you.

1. Reduce the number of variables in your data set so that you can use all or most variables.
2. Label your variables with meaningful names (use Data/Information menu on your data editor).
3. Always open you data set onto the screen before you draw a diagram.
4. Deploy all measured variables on the drawing window if you are creating a path model and create all factor structures if you are creating a factor model.
5. Move and lay out all variables and factor structures to logical and readable positions. For example, make your reading flow from top to bottom and from left to right. Thus, the final diagram will not be confusing.
6. As a last step, connect all the regression coefficients or covariances.

For experienced **Diagrammer** users, who have used EQS for Windows 5.6 or earlier versions, the following are the changes on **Diagrammer** (in the following text , **EQS 5.7 includes EQS 5.7b**):

1. A new factor structure dialog box will appear if you have an ESS file open. This new dialog box lists all the measured variables so that you can select them as indicators to create a factor structure.
2. Most drawing functions will remain active after their use. For example, if you click on an one-way arrow tool, and move on to create a regression coefficient, the shape of your mouse cursor will remain the same so that you can draw another regression coefficient immediately. You can reset the mouse cursor shape to arrow point by clicking on your **right mouse button**.
3. When deploying measured variables on the drawing window, you have the option to deploy multiple variables. This option will be useful when you want to create a path model.
4. The default viewing label option is turned on, so that instead of seeing V1, V2,. .. etc., you will see the variable labels on your diagram. You can always reverse this if you want.
5. We changed the default drawing window to a full view, so that you can see and draw the entire piece of paper when it is printed. Of course you can go to a close-up view.
6. One-way and two-way curved arrows have changed so that they draw a smoother curved line. **By default, the curved line faces left. If you want to draw a curve facing right, press the SHIFT key before connecting two variables**.

Here is a brief further description of the changes. You might want to perform the actions described on a model of your own, to get some practice.

We also test EQS for Windows 5.7b on the newly released Windows 98. EQS has been behavior quite well. For those who are concerned about the compatibility of EQS on Windows 98, this test may ease your concern.

1. Create a Factor Model

The following section will illustrate the best way to create a factor model.

Step 1: Open an EQS Dataset

EQS works best with a customized EQS dataset (i.e. an *.ESS file). Before you create any model, you should either enter a new dataset using EQS' data entry function, import a raw data or covariance matrix from an ASCII file, or import a third party system file such as an SPSS system file.

After the dataset is imported, you should name each variable with a meaningful name so that these names can be used when creating a diagrammed model. Our illustration assumes that you have an EQS dataset present in the data editor.

Step 2: Create Diagram from Factor Structure

The best way to create a factor model is to create individual factor structures through the <u>Factor Structure</u> icon. This icon is located in the middle of the vertical icon tools in the **Diagrammer** window. Its shape is a little factor structure (factor with its indicators).

Click on the <u>Factor Structure</u> icon and you will see your cursor become a cross with a little factor structure shape in the lower right part of the cursor. Move the cursor to the client area (or display area) of your diagram window and click on the **left mouse button once** on the screen. A *Factor Structure Specification* dialog box will appear.
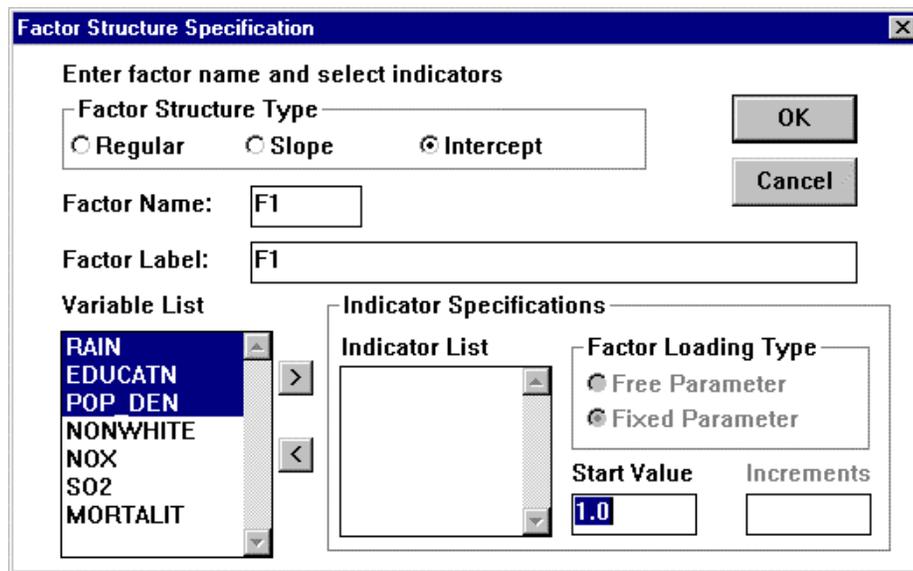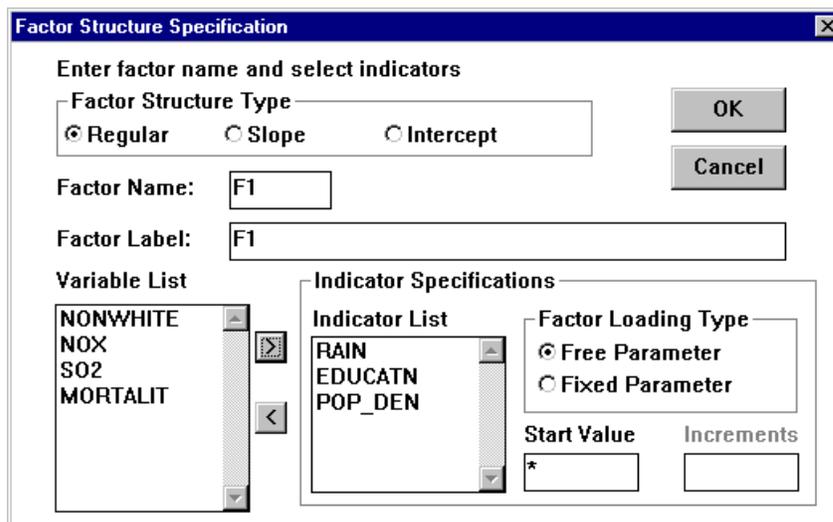

**Figure 1: Factor Structure Specification Dialog Box**

Please note that all the variables in your data set will be presented in the **Variable List** box (keeping this list short is one reason to limit your data set primarily to the variables that you plan to use in the model). To create a factor structure, you must move target variables from **Variable List** to **Indicator List.** You do this by first selecting all the relevant variables in the **Variable List**. If you need to select non-continuous variables from the list, **hold down the CTRL key** (known as the control key) **and use your mouse to click on the target variables**.

Once all the variables in a desired factor structure have been selected, push on the **>** button to move all the selected variables to the **Indicator List**. They move all at once. If you change your mind, you can modify the choice of variables by moving one or more variables back to the Variable List from the Indicator List by using the < arrow key. Obviously, you can move back or forth as you like. At some point you should have a result as shown in Figure 2.

Figure 2: Factor Structure Specification with Indicators

This concludes variable selection. There are many other functions in this dialog box, some of which are new and others of which are old. These other functions will be discussed below. Let's click on the **OK** button to create the factor structure. A new factor structure will be created, as shown in Figure 3.
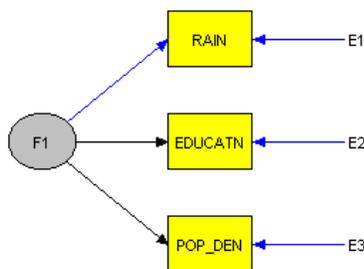
Figure 3: A Factor Structure

By default, EQS will make the variance of the factor as a free parameter. All the factor loadings will be set as free parameters except the first one, which is set as a fixed parameter. On the screen, a blue line means a fixed parameter, while a black line represents a free parameter.

Step 3: Connecting Factor Structures

We will create a two-factor Confirmatory Factor Analysis (CFA) model in this example. We first put two factor structures on the screen. We then need to connect them with a covariance. In **Diagrammer**, a covariance is presented as a two-way arrow.

To draw a two-way curved line, you have to **select** the icon with curved two-way arrowhead. Then move the cursor back to the drawing window. The cursor will become a small cross with a little two-way arrow

line under it. **You must select the first variable where the curved two-way arrow line is going to be drawn. Then, hold down the left mouse button, and move the cursor until the cursor is well into the target (2nd) variable, and then release the left mouse button**. A two-way curved arrow line facing left will be drawn on the screen. **Notice that after the curved line has been drawn, the shape of the cursor still remains the same**. This mean that you can draw another two-way curved arrow line immediately.

To turn off the continuous cursor, you must click on the right mouse button.

You can also draw a curved line that faces your right hand side. To do this, hold down the **SHIFT** key while drawing the curved line. For example, hold down the SHIFT key and click on the E1 variable; keep pressing the left mouse button and move the cursor down until the cursor is well inside the E4 variable. EQS will draw a curved line facing your right, as you can see in Figure 4.
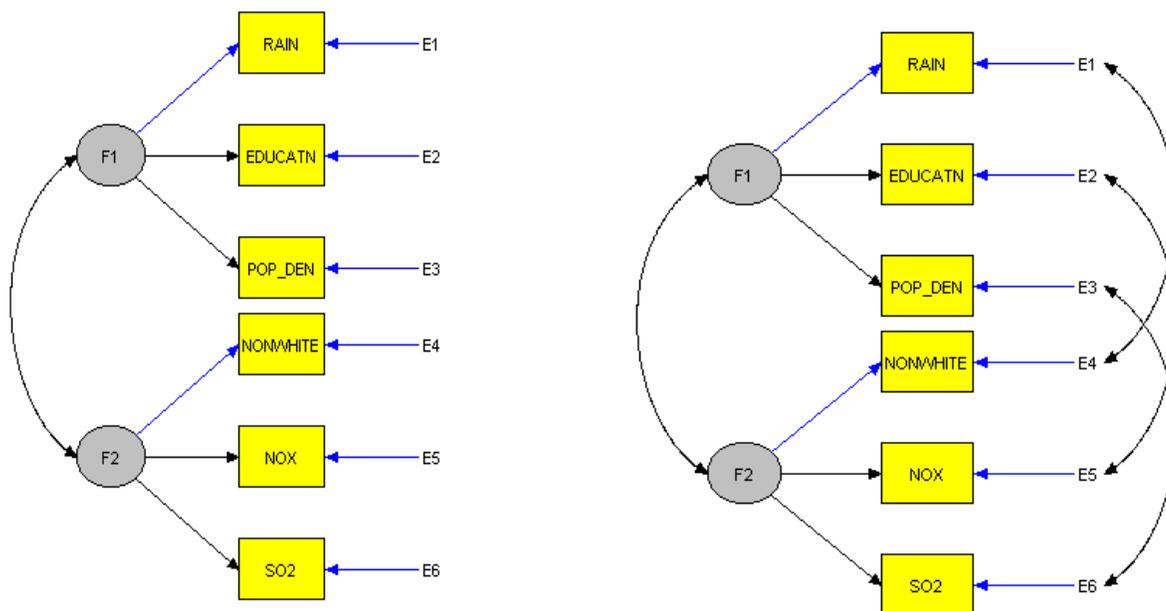
Figure 4: Two-factor CFA Model

Step 4: Run an EQS Model

You have created an EQS model and can now run it. Please consult the *EQS for Windows User's Guide* for details.

Step 5: Present your Model

After your EQS model has run, you have to inspect your model fit. EQS provides an easy way for you to do this, while also creating a good presentation of your model for later printing. From your **Diagrammer View** menu, you can pull down the menu and select **Diagram Title.** A **Diagram Titles** dialog will appear. By default, EQS provides a generic title which briefly describes your model and its fit. You can enter your own title in this single line edit box. Although appearing as a single line, the printing on the diagram will cover multiple lines breaking at each ";". **The semicolon means line-separation**.

The bottom rectangle in Figure 5 shows the title line. You will note that it has some strange abbreviations that start with a back slash (\) character. The back slash starts a control key. Meaningful numbers from your model output will replace these control keys after the model is run. **Please note that the control key values will be available only after your EQS model has been run**. In the example, the chi-square

statistic, its degrees of freedom, and the associated probability value will be put into the diagram after the model has been run. A listing of possible information to present, i.e., control keys and what they represent, can be obtained by pressing the **Key Words**. This list is given at the back of this document.
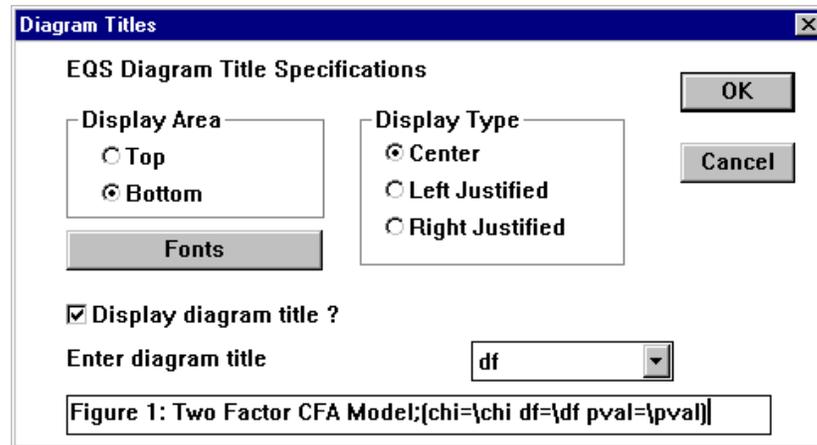

Figure 5: Diagram Titles

As you can see in Figure 5, displaying the title is an option. It is also subject to display choices that you can make. Note also that **the diagram title is visible only in the Full View mode**. It will print only if the **Display diagram title** option is chosen.

Step 6: Printing a Diagram

You are encouraged to examine your model before printing it on paper. Since the diagram window you are working with may be off-centered relative to a piece of paper, you should be sure to get a full view of your diagram. To get a full view, go to the **View** menu of the diagram window, pull down the menu and select **Full View.** If your diagram is not centered, you may want to:

        a.   Go to **Edit** menu and **Select All Diagram Objects**
        b.   Go to **Layout** menu and **Group** all the diagram objects
        c.   Go to **Layout** menu and do an **Align Page Center** and **Align Page Middle.**

By doing these steps you will get a good printed copy of your diagram. A reduced size example is shown next.
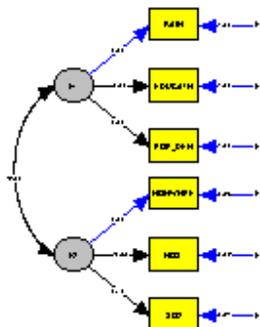

Figure 1: Two Factor CFA Model
(chi=103.65 df=8 pval=0.00)

Figure 6: Full View of a Two Factor Confirmatory Factor Analytic Model

2. Create a Path Model

A path model uses only measured variables. It sometimes is also called a simultaneous equations model. EQS **Diagrammer** lets you deploy all the measured variables on the drawing screen in a convenient way. Thus, you can arrange them in the desired location and build the model.

Step 1: Open an EQS Dataset

Before creating a path model, you must open a data set. Make it the active window on EQS' data editor.
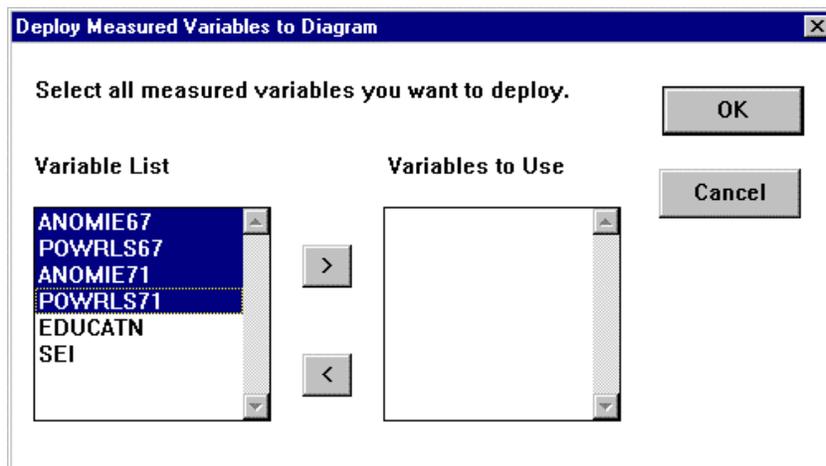
Step 2: Deploy Measured Variables

After your data editor is on the screen, click on the **Diagrammer** icon from the horizontal tool bar. Wait until the diagram has opened, then click on the vertical tool bar icon that represents a V variable. You will be asked if you want to deploy more than one variable in the draw window.
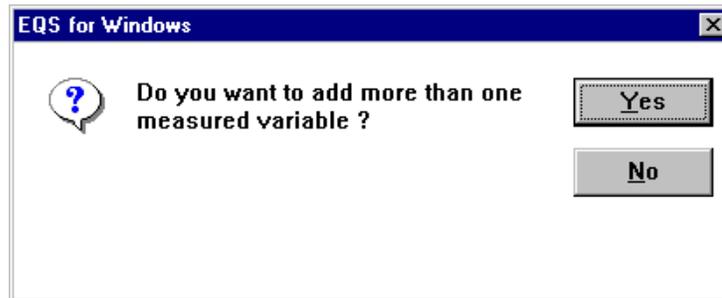
**Figure 7: Multiple Variable Query Box**

If you answer *No* to this question, you will be able to place variables sequentially without selection. Move your mouse cursor to the drawing window. Your mouse cursor will turn to a cross with a small rectangle attached to its lower right. Then, you are ready to deploy a measured variable: with every click on the diagram window, one measured variable will be put on the screen. You can see that these variables are deployed according to their sequence in the data. Click on the *YES* button if you want to select variables to place into the draw window. A second dialog box will appear:

Figure 8: Multiple Measured Variables Deployment Dialog Box

You must select the variables you want to use in the model, then click on the > button. The variables you have just selected will move to the list box **Variables to Use**. You must verify whether these variables are the ones that you want to use in the model. If they are correctly chosen, click on the OK button to deploy the variables onto the draw window. If not, select variables and use the > and < arrow keys to move the variables into their correct position. Then click OK.

In Figure 9 we give an example that shows four variables were selected for a path model. After clicking the OK button, these variables will be deployed onto the draw window.
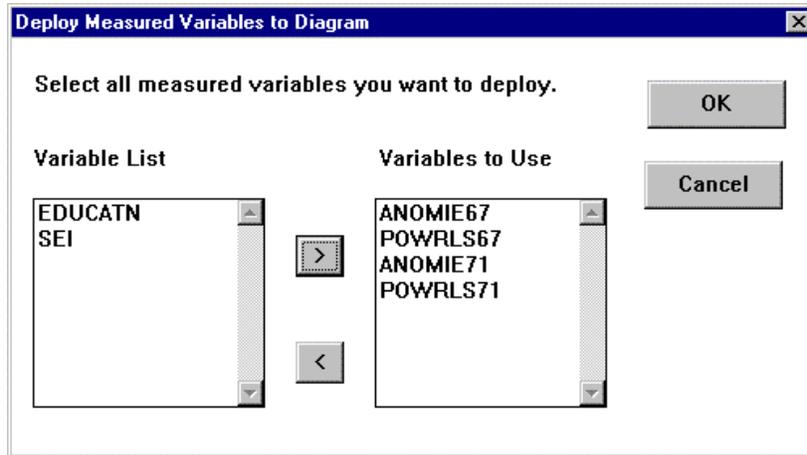
Figure 9: Variables to Use in a Path Model

Step 3: Layout Variables

It is important that your diagram be laid out in a meaningful fashion. The causal flow should go in a certain direction, for example, you could put the ultimate dependent variables on the right hand side of the draw window, the independent variables on the left, and mediating variables in between. The purpose of a good layout is to let your reader easily understand the causal flow implied by your diagram in a natural way. Individual or groups of variables can be selected, and then moved to a good location on the page.

After variables have been placed and spaced meaningfully on the draw window, you can also align them carefully, especially if you are ready to prepare a publication quality drawing. The **Layout** menu provides a number of options for you to align variables vertically (**Align Vertical**) as well as horizontally (**Align Horizontal**). It can space them so that the variables have an even space between them. When using the layout tool, you must select target variables. Only selected variables are affected by the layout tool.

Step 4: Connect Variables

After all variables are nicely laid out, you can connect these variables. In a path model, there are two kinds of connections. These are regression coefficients and covariances. Regression coefficients are created with the one-way straight arrow tool, and covariances with the two-way curved tool.

To connect variables with a regression coefficient, you first click on the one-way straight arrow tool. The mouse cursor will become a little cross with an one-way arrow on its lower-right corner. Then use a left mouse click on the originating variable, hold down the mouse button, and move the mouse cursor until the cursor is well inside the target variable. Let go. A straight one-way arrow line will be drawn between origin and target variables, with the arrowhead pointing to the target variable. An error variance will also automatically attach to the target variable.

To correlate two independent variables, use the two-way curved arrow tool, applying the same operational principle. That is, click on the originating variable, hold down the mouse button, move the mouse pointer, and release the mouse button when it is well inside the target variable. Remember that **the default curve line always faces left, unless you hold down the SHIFT key when drawing the two-way arrow.**
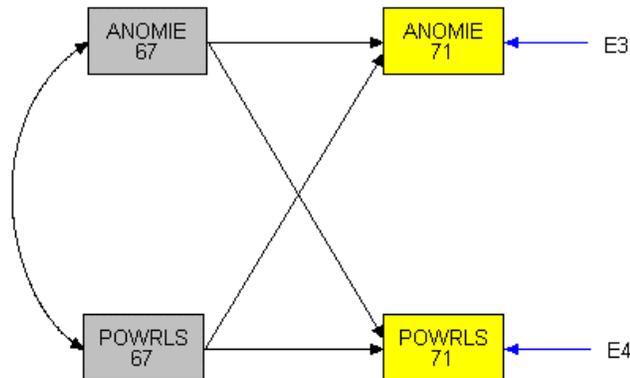
Figure 10: A Four Variable Path Model

Step 5: Run the Path Model

When a model is completely drawn and carefully laid out, your are ready to run this model. You must go to the BUILD_EQS menu and click on the **Title** menu, fill in the title of your model in the dialog box, choose additional options from the list if desired, finally click on **Run/EQS 386**. You will see a DOS screen (typically, blue) open and display the status of your model until the model run has been completed. Depending on your system setup, you may have to close the DOS window after the EQS model run is finished. You will have to open the output file so that model statistics can be imported to your diagram file.

Step 6: Display Diagram Title and Model Statistics

As noted above, you can display EQS model statistics using the **Diagram Titles** option. After your EQS model has run, click on **View** menu and select **Program Title**. You will be given a dialog box in which you can specify some display text along with some keywords. These keywords all start with a control character "\" or a back-slash character. If a character string following "\" matches a set of pre-defined keys, the keyword will be replaced by equivalent output statistics from the EQS run.
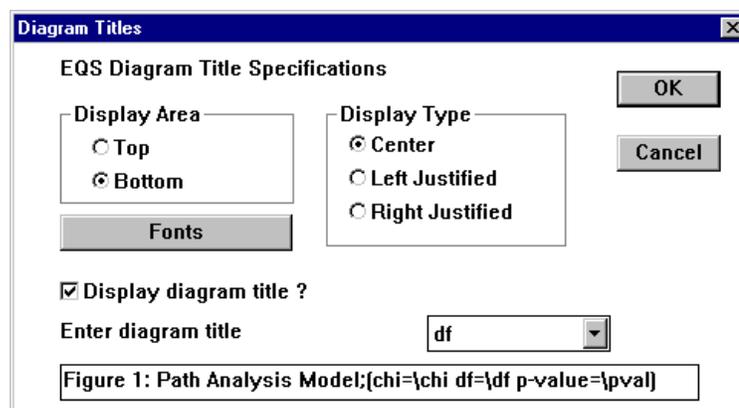
Figure 11. Example of Diagram Titles

Please note that the semicolon ";" character is the line separator in the edit box. Based on this dialog box, the string "Path Analysis Model" will be displayed in the first line of the title, and the model statistics will be displayed on the second line. Figure 12 illustrates a diagram with title information.
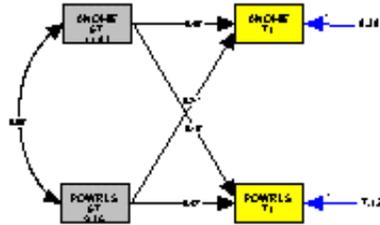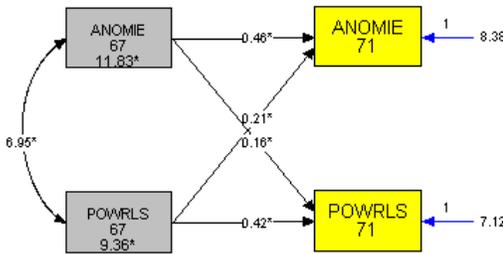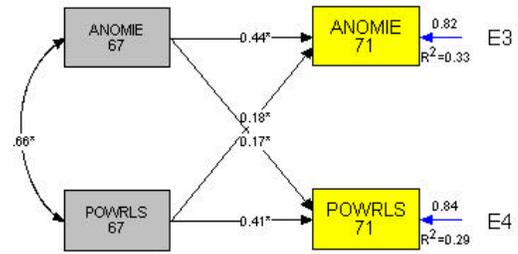

Figure 1: A Path Model
Chi sq.=341.86 P=0.00 CFI=0.78 RMSEA=0.61

Figure 12. Model with Title and Results

Step 7: Display your Diagram

Diagram with parameter estimates   **Diagram with standardized solution**

EQS 5.7 for Windows also made some changes in its display of starting values, parameter estimates, and the standardized solution with the **View** and **Estimates** choices. The **Start value** option no longer gives starting values; the diagram that is obtained with this choice is the starting model without any estimates, and with "*" denoting free parameters. The other options are shown in the two diagrams illustrated above. The left hand side is the diagram with **Parameter estimates** displayed. Please note that there are numbers in place with all independent variables. These numbers are the variances of the variables. For example, the variance of ANOMIE67 is 11.83 and the variance of POWRLS67 is 9.36.

The diagram in the right hand side displays the **Standardized solution** of the model. There is no number in the place with the independent variables because their variances are 1.0 when standardized. However, there is $R^2 = 0.33$ on the right hand side of the equation. This newly introduced information is the squared multiple correlation coefficient of the equation. The ANOMIE71 diagram R^2 corresponds to the following equation:

$$\text{ANOMIE71} = 0.44*\text{ANOMIE67} +   0.18*\text{POWRLS67} + 0.82 \text{ E3} \qquad \text{with } R^2=0.33$$

We hope that the new display will convey more complete information on important aspects of your model.

3. Create a Latent Growth Curve Model

The Latent Growth Curve Model has become very popular in recent years. It is a model that measures growth or progress on some well-understood measurement variables. The data for this type of model represent repeated measures of the same variable over time. Typically, there are several repeated measures, but not as many as there would be in a time series design. The time lags between measurement can be equal interval or unequal interval. Furthermore, the repeated measures may represent repeated observations on a measured variable or repeated measures on a latent variable which has its own indicators via an appropriate factor structure.

We shall use a hypothetical model with three time points to build a latent growth curve model.

Step 1: Open an EQS Dataset

It is a standard practice to open an EQS *.ESS data file before building any model. We shall use a dataset called GROWTH.ESS with three variables. These variables are measuring the same event at three different time points. The time intervals between measurements are equal. The variables are named TIME1, TIME2, and TIME3.

Step 2: Deploy the Latent Growth Curve Model

To create a Latent Growth Curve model we need to start with a factor structure as the basic building block. Click on the **Diagrammer** icon at the horizontal tool bar and then click on the factor structure icon on the vertical tool bar of the draw window. You will see a **Factor Structure Specification** dialog box appear.
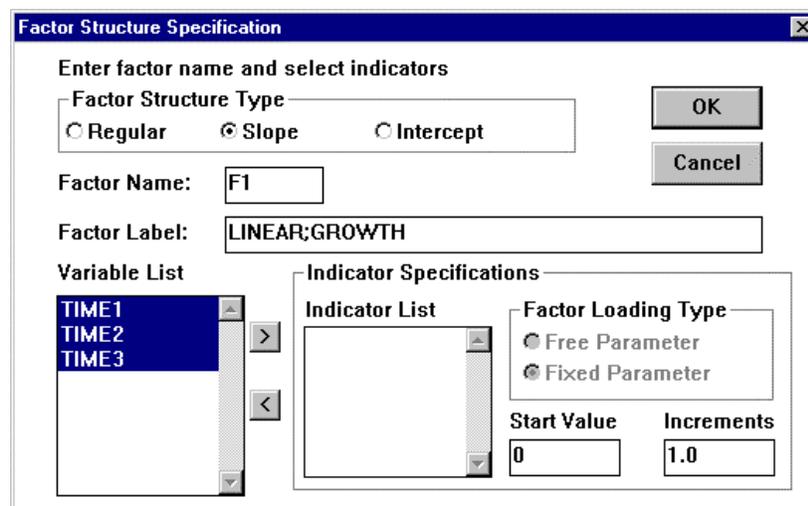

Figure 13: Factor Structure Specification Dialog for Latent Growth Curve Model

The top part of the box makes it apparent that there are three possible types of factors. In addition to the default **Regular** factors – the usual kind – there are **Slope** and **Intercept** factors. Regular factors have the typical pattern of free factor loadings. In contrast, slope and intercept factors have a very specific pattern of fixed parameters. By default, there are no free loading parameters. We recommend that you change the **Factor Structure Type** to a **Slope** factor. By default, the factor label called "LINEAR GROWTH" appears; you can change this name as you like. The semi-colon in the edit box assures that this label will be displayed on two separate lines. In the bottom left **Variable List** are three variables representing three

10

time points of measurement. You must click on the "moving" button ">" to move the variables from the **Variable List** into the **Indicator List**. Click the OK button when done, and you are ready to move on to the remaining specifications for a growth curve model.

Step 3: Add an Intercept Factor and a Constant Variable

You need to add a factor that represents the starting point or **Intercept** of the growth process.   After you have specified the **Slope** factor, the program automatically asks you about whether you also will want to specify an **Intercept** factor, and a **Constant** variable. The intercept factor gives information about the starting point of the growth process. The constant is needed in the standard model where you are modeling both means and covariances, i.e., a moment structure. If you are modeling only the covariances, the constant is not needed. The dialog box is shown in Figure 14.
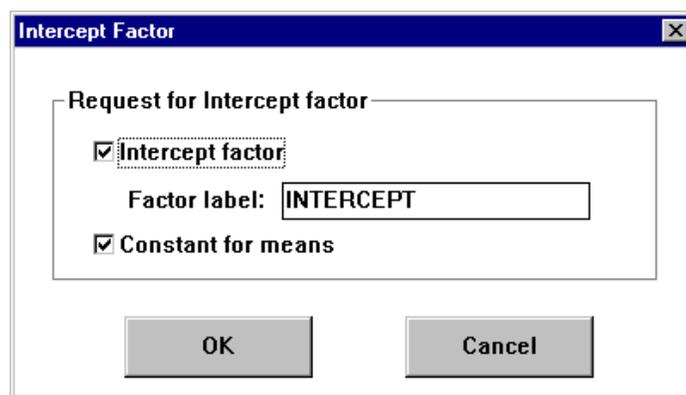
**Figure 14: Check Boxes for Intercept Factor and Constant**

The default is to include both the intercept factor and the constant, so you can click OK if that is what you want. However, suppose that you do <u>not</u> want these additional features. Then, uncheck both of these boxes, and click OK. The result is shown in Figure 15.
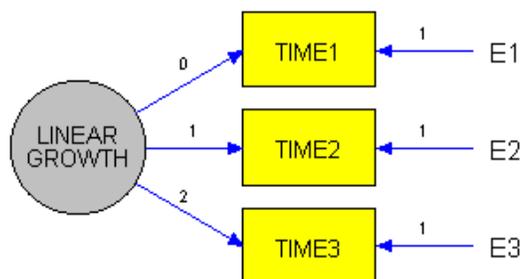
Figure 15: Factor Structure for Linear Growth Factor

As you will note, this factor structure has created a basic building block for an equal time interval linear growth factor. What makes this factor unique is that all the paths from the factor to the variables are fixed at known values as shown in blue; these values will not be changed during iterations. The factor loadings are all fixed, and the fixed values are 0, 1, and 2. If you do not have equal time intervals between measurements, you will have to calculate what the appropriate fixed coefficients should be, and replace the default values we provide. Please notice that, technically, the path from LINEAR GROWTH to TIME1 is not really there – a zero path has no effect. It would be possible, and indeed less confusing, to simply to remove it from the diagram. However, due to standard presentations in the field, this is one case where we leave a zero, i.e., nonexistent, path in the diagram.

In the typical latent growth curve model, however, you will also add the intercept factor and, most likely, a constant variable, and so the check boxes of Figure 14 would stay at their checked default values and you would simply click OK. In that case, you immediately would get the final result shown in Figure 16, which includes the two latent **Slope** and **Intercept** factors, as well as the **Constant** which is needed to transform the model from a covariance structure to a mean and covariance structure model.
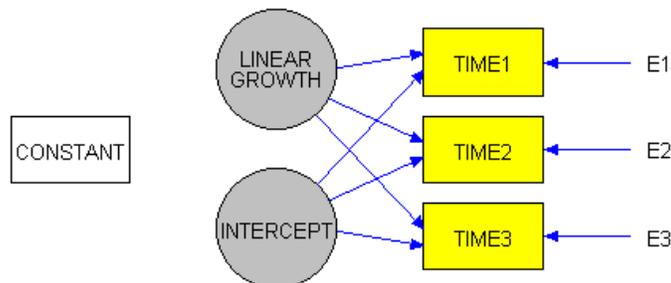
Figure 16: Linear Growth and Intercept Factors with Constant

Notice that the INTERCEPT and CONSTANT factor labels have been used by default. If you want to change these names, do so in the usual way by double-clicking on them and making appropriate changes in the dialog box that appears. From the blue line shown in Figure 16, it also will be apparent that the paths from the **Intercept** factor to its measured variable indicators are all fixed parameters. In fact, each of these paths is fixed at 1.0, as you could verify by double-clicking on each path and seeing the default value of the coefficient in the dialog box that appears.   The **Intercept** factor deals with the starting point of the growth process.

The **CONSTANT** variable is the standard V999 constant in EQS' usual setup, but here it is called "CONSTANT" due to conventions in the field. V999 is what transforms a covariance structure into a mean structure model. As you can see from Figure 16, by default there are no connections from the CONSTANT to the factors or the variables. These should be added by you. In the standard growth model, you should add a one-way straight arrow from the **Constant** variable to each of the two factors **Linear Growth** and **Intercept**. These arrows should be treated as free parameters, since they represent the average linear growth coefficient and average intercept, respectively, which usually are unknown and need to be estimated. The relevant residuals D1 and D2 will be added automatically. These residuals represent individual differences in linear growth, and individual differences in intercept, respectively. In general, these residuals should be correlated, and you should create that correlation by adding the two-way arrow between D1 and D2 after they appear. As a result, you should obtain something like Figure 17.
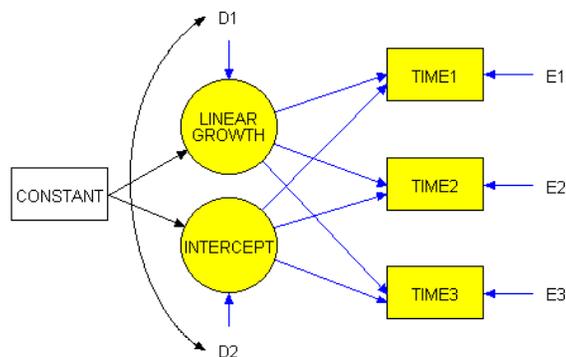
Figure 17: Complete Two-factor Latent Growth Curve Model

The model we created is sometimes called a two factor **Initial Status Latent Growth Model** with equal time lags. When the time between successive measurements of your variable is not given in equal time intervals, the fixed values of the coefficients have to be adjusted. Please also note that we only discussed linear growth in this example. A general growth curve model can include exponential growth, cubic growth, or even quadratic growth factors in your model.

There are also other types of Latent Growth Curve Models such as the **Time Averaged Latent Growth Curve Model** and the **Spline Latent Growth Curve Model**. These two types of models involve more complex computations of start values. These will not be covered here. If you are interested in the Latent Growth Curve model, you are encouraged to find other literature and publications for further study.

We did not emphasize here an alternative sequence you could have used to create the growth curve model of Figure 17. In our presentation we presumed that you would start with a **Slope** factor, as shown selected in Figure 13. However, it would have been perfectly all right to start with the **Intercept** factor by making the appropriate selection (see Figure 13). In that case, a dialog box similar to Figure 14 would appear, asking you whether you also intended to create a **Slope** factor and a **Constant**. Depending on your choice, you would get only the **Intercept** factor, or also a **Slope** factor, or also the **Constant**.

4. Keywords Available for Diagram Title

We have previously mentioned in several places (i.e. Step 5 of Create a Factor Model and Step 6 of Create a Path Model) that you can specify some keywords in your diagram title so that it will achieve a more dynamic output. These keywords provide for automatic inclusion of key parts of a model run as specified by you. The keywords you can use are as follows:

\df	Degrees of freedom
\null	Independence model chi-square value
\chi	Model chi-square
\pval	Normal theory p value
\nfi	Bentler-Bonett fit index
\nnfi	Bentler-Bonett non-normed fit index
\cfi	Comparative fit index
\afit	AGLS fit index
\aafit	AGLS adjusted fit index
\gfi	LISREL's standard fit index
\agfi	LISREL's adjusted fit index
\rmr	Root mean-square residual
\srmr	Standardized root mean-square residual
\rmsea	Root mean square error of approximation
\rmlo	Lower bound of RMSEA confidence interval
\rmhi	Upper bound of RMSEA confidence interval
\iter	Number of iterations to convergence
\rchi	Robust (Satorra-Bentler) chi-square value
\rpval	Robust p-value based on robust chi-square
\rcfi	CFI based on robust chi-square
\yb	Yuan-Bentler AGLS corrected chi-square
\ypval	Pval for Yuan-Bentler chi-square
\ycfi	Yuan-Bentler corrected comparative fit index
\np	Number of free parameters
\nc	Number of cases in your data file
\fname	File name that houses this model

5. Summary of Changes in EQS for Windows 5.7

Most of the changes in EQS for Windows 5.7 are in Diagrammer. Most of these changes have been mentioned above. We want to re-iterate these changes, and note some added points.

A.   Full view is the default Diagrammer window

Previous version of EQS used an actual diagram size as the default Diagrammer startup window. The advantage of this is that the drawing objects are clearly visible. There is one draw back on this approach: it is hard to draw a diagram that will fill the complete page. We decided to take some users' suggestions to make the full view as the default startup window, and make the drawing tool available. Diagram titles with dynamic results show in this view only.

The Diagrammer startup window has been formatted to the size of a standard 8.5" x 11" sheet of paper. You have to fit all your drawing objects within the boundary of the drawing area.

B.   A multiple drawing feature creates the same type of object repeatedly

As you may have noticed, prior to EQS 5.7, you had to click on the vertical tool bar whenever you wanted to create a new drawing object. Not only that, you needed to click on the tool bar even if you wanted to create the same object. We now eliminate some redundant clicks by introducing the multiple drawing feature. Now you can create the same drawing object repeatedly without ever having to go back to click on the vertical tool bar.

To use the multiple drawing feature, you only need to repeatedly draw the same object. The drawing cursor will stay in the same shape with the same function until you (1) click on the vertical tool bar to reset it, or (2) **click on the right mouse button to reset the shape of the cursor**.

C.   Curved lines are smoother

A free hand drawing technique was used to draw a curved line in Diagrammer. This is no longer necessary. The previous curved line implementation allowed you to customize the fullness or flatness of the one-way or two-way curved lines, but this may not be a good idea after all. We accepted some users' suggestions to smooth the curved line in the program.

To draw a one-way or two-way curved line, you only need to activate the curved line tool, click on the original object, hold down the mouse button and drag across the diagram window, and release the mouse button when the mouse pointer is well inside the destination object. A one-way or two-way curved line will be drawn with the curve **facing left** if both objects are relatively vertical to each other, or **facing down** if both objects are relatively horizontal to each other**. If you need to draw a curved line facing in the opposite direction, you must hold down the SHIFT hey and do the same drawing**.

D.   Child objects move automatically and meaningfully

A child object is defined as the drawing object that must coexist with another drawing object, such as an E variable that is attached to a V variable, and a D variable that is attached to an F variable. An E is V's child object, and a D is F's child object. In general, if you move a parent object, you probably want to have its child object nearby for clearer presentation.

In EQS 5.7, whenever you move a V variable, its E variable will be moved accordingly and its relative position will remain unchanged. Likewise, if you move an F variable, its associated D variable will be moved accordingly.

E. Selected objects move more logically

In EQS 5.6 and earlier versions, you had to group some drawing objects so that you could move them across diagram window simultaneously, maintaining the same relative position. You don't need to group them anymore. When several objects are selected, if you drag any of the objects to its new location in the window, the other selected objects also will be moved to the new location, and maintaining the same relative position as the dragged object. This implementation allows you to move several objects at once without the need to group them.

F. A new diagram title section dynamically presents model results

Most key model information, test statistics, and fit indices are saved in the diagram file if you use Diagrammer to create and run a model. This information can be dynamically displayed on the **Full View** diagram window, and printed, if you enter their keywords in the Diagram Title section of the View menu. A default diagram title will be given upon the completion of your model run. With a minor modification, you can create an informative diagram for your model presentation.

G. Drawing object information is displayed in the title bar

When you click on any drawing object, its information -- such as, what the variable is and its label, or a fixed or free parameter and the parameter labels -- will be displayed in the title bar of the drawing window. This is especially useful in the full view, which is now used as the default startup window for Diagrammer, where variable labels and parameter information may be too small to be visible otherwise.

H. Variances of independent variables with parameter estimates are displayed

Previous version of Diagrammer did not to display the variances of independent variables. This information is now added to the Diagrammer. If the independent variable is a V or an F variable, the parameter variance will be appended to the variable label. If the independent variables are E or D variables, the variances will be displayed in their place.

I. Growth curve models are convenient to create

Slope and intercept factors are now created automatically, and the constant needed to specify the mean structure is generated as well. Only minor modifications need to be made to finalize the setup for standard linear growth models.

J. An R–square is displayed for each equation

In presenting the results of an analysis, one often wants to present the R^2 to summarize the predictability of the dependent variable in an equation. EQS 5.7 for Windows now computes this information and prints it in the standardized solution of the EQS output file. This information also is given in Diagrammer when presenting the standardized solution.

K. A single variable and its connections can be viewed with Control-Click

In a complex diagram, a lot of drawing objects may be seen within a small area. Too many such objects may be confusing. A vastly simplified view is now available. You can invoke a single variable display option by **holding down the Control key and clicking on a variable**. As a result, you will see only those paths coming from and going to the targeted variable. The other connections will be turned off. As a result, you will get a clear view of the relationships involving that targeted variable. You can then add or delete paths from this variable to other variables, and the reverse, without the interference of other connections.

L. Resampling procedures can be applied to ESS files

EQS now supports resampling procedures (i.e., bootstrap or jackknife) using ESS files. In previous versions, you could only use ASCII data files when running resampling procedures.

M. Symbolic names are supported in model files

EQS now supports the use of symbolic names in a limited way. You can use the real variable names in /EQUATION, /VARIANCE, and /COVARIANCE sections. The symbolic name should be defined in the /LABEL section, where each variable label should be 8 or fewer characters in length without any embedded blank characters. Please note that EQS will allow you to use any combination of uppercase or lowercase characters, but these characters will be converted into uppercase automatically and so printed in the output.

EQS will read the symbolic names and perform a regular analysis. There are no changes in EQS' printout, however, so the output will correspond to that previously available. The following model file provides an example of the use of names in model specification.

```
/TITLE
 An example of using symbolic variable names in a path analysis model
/SPECIFICATIONS
 DATA='MANUL4.ESS';
 VARIABLES=6; CASES=632;
 METHODS=ML;
 MATRIX=COVARIANCE;
/LABELS
 V1=ANOMIE67; V2=POWRLS67; V3=ANOMIE71; V4=POWRLS71; V5=V5;
 V6=V6;
/EQUATIONS
 ANOMIE71 =   *anomie67 + *powrls67 + E3;
 POWRLS71 =   *anomie67 + *powrls67 + E4;
/VARIANCES
 anomie67 = *;
 powrls67 = *;
 E3 = *;
 E4 = *;
/COVARIANCES
 anomie67 , powrls67 = *;
/END
```

N. EQS now reads SPSS® 8.0 *.SAV files

SPSS Inc. has just upgraded its popular statistical software to version 8.0 and thus its system file (i.e. *.SAV files) also has been upgraded. EQS 5.6 for Windows cannot import *.SAV files produced by SPSS 8. We have hence upgraded the SPSS *.SAV file importing facility so that EQS can import SPSS 8 *.SAV files. We thank SPSS' release of its file importing DLL for public use.

O. Summary statistics from simulation results are printed out

EQS now prints basic summary statistics to describe results of any simulation study concerned with test statistics, fit indexes, parameter estimates, standard errors, and robust standard errors. These summary statistics are divided in three parts. First of all, summary results for all replications are reported. Next, summary results on all successful runs are given. Finally, the results of all failed runs, i.e., runs with condition codes or that did not converge, are printed.

There are 6 pieces of statistical information provided for each parameter in the simulation. These statistics are mean, standard deviation, skewness, kurtosis, the boundary marking the lower [5th]

percentile of the simulated scores, and the boundary marking the upper 5th percentile of the simulated scores.

These summary statistics are listed at the bottom of the EQS output. An example of such summary statistics is given as follows:

```
SUMMARY STATISTICS OF REPLICATIONS FOR METHOD=ML

SUCCESS (CONVERGENCE WITH NO CONDITION CODE) OCCURRED IN
    10 REPLICATIONS OUT OF   10 (100.00 PERCENT)

NUMBERED STATISTICS ARE
   1. NULL MODEL CHI-SQUARE
   2. MODEL CHI-SQUARE
   3. PROBABILITY LEVEL
   4. BENTLER-BONETT     NORMED FIT INDEX
   5. BENTLER-BONETT NON-NORMED FIT INDEX
   6. COMPARATIVE FIT INDEX
   7. LISREL GFI
   8. LISREL AGFI
   9. ROOT MEAN-SQUARE RESIDUAL
  10. STANDARDIZED ROOT MEAN-SQUARE RESIDUAL
  11. ROOT MEAN-SQUARE ERROR OF APPROXIMATION (RMSEA)
  12. CONFIDENCE INTERVAL FOR RMSEA (LOWER BOUND)
  13. CONFIDENCE INTERVAL FOR RMSEA (UPPER BOUND)

   STATISTIC          1         2         3         4         5
   MEAN          476.8342    8.8780    0.5496    0.9814    1.0026
   STANDARD DEV.  38.2943    3.3627    0.2674    0.0068    0.0073
   SKEWNESS (G1)  -0.1867   -0.2147    0.2424    0.3935    0.4249
   KURTOSIS (G2)  -1.4742   -0.6922   -1.1389   -0.9946   -0.5244
   LOWER  5%     425.9869    4.3598    0.2435    0.9736    0.9944
   UPPER  5%     521.0556   12.8500    0.9080    0.9910    1.0128

   STATISTIC          6         7         8         9        10
   MEAN            0.9984    0.9804    0.9706    0.2493    0.0355
   STANDARD DEV.   0.0027    0.0112    0.0169    0.1416    0.0104
   SKEWNESS (G1)  -1.6949   -0.4795   -0.4794    0.8454   -0.2606
   KURTOSIS (G2)   1.9514   -1.2257   -1.2261   -0.6098   -0.6642
   LOWER  5%       0.9944    0.9639    0.9458    0.1165    0.0208
   UPPER  5%       1.0000    0.9908    0.9861    0.4821    0.0493

   STATISTIC         11        12        13
   MEAN            0.0171   -9.9000    9.9911
   STANDARD DEV.   0.0239   31.3065   31.2746
   SKEWNESS (G1)   0.8962   -2.6667    2.6667
   KURTOSIS (G2)  -0.5241    5.1111    5.1111
   LOWER  5%       0.0000  -49.5000    0.0646
   UPPER  5%       0.0517    0.0000   49.5680


PARAMETER ESTIMATES

   PARAMETER        E1,E1     E2,E2     E3,E3     E4,E4     E5,E5
   MEAN            0.9691    0.9178    1.0145    0.9410    0.8962
   STANDARD DEV.   0.2166    0.1388    0.2715    0.1863    0.3901
   SKEWNESS (G1)   0.2234   -0.4844   -0.0037   -0.8057   -0.1322
   KURTOSIS (G2)  -1.0037   -0.2317   -1.2919   -0.1010   -1.3596
   LOWER  5%       0.6835    0.7065    0.6551    0.6632    0.3830
   UPPER  5%       1.2906    1.0995    1.3722    1.1516    1.3845

   PARAMETER        D1,D1     D2,D1     D2,D2     F1,V999   F2,V999
   MEAN            0.9558    0.0323    1.0445    0.0083    0.9909
   STANDARD DEV.   0.2734    0.1010    0.1533    0.1341    0.0946
   SKEWNESS (G1)  -0.4774    0.0671   -0.6367    0.1506    0.0141
   KURTOSIS (G2)  -0.1450   -1.3622   -0.1993   -0.9866   -0.8315
   LOWER  5%       0.5150   -0.0972    0.8245   -0.1658    0.8703
   UPPER  5%       1.2961    0.1596    1.2178    0.1994    1.1195


PARAMETER STANDARD ERRORS

   PARAMETER        E1,E1     E2,E2     E3,E3     E4,E4     E5,E5
   MEAN            0.2269    0.1650    0.1727    0.2123    0.3335
   STANDARD DEV.   0.0262    0.0203    0.0376    0.0165    0.0471
   SKEWNESS (G1)   0.4581   -0.3686   -0.0306   -1.5213    0.2140
   KURTOSIS (G2)  -0.9738   -0.4827   -1.3660    1.8720   -1.1172
   LOWER  5%       0.1956    0.1331    0.1233    0.1872    0.2714
   UPPER  5%       0.2671    0.1915    0.2215    0.2273    0.3970

   PARAMETER        D1,D1     D2,D1     D2,D2     F1,V999   F2,V999
   MEAN            0.2309    0.1357    0.1619    0.1233    0.1067
   STANDARD DEV.   0.0320    0.0151    0.0210    0.0101    0.0072
   SKEWNESS (G1)  -0.6465   -0.0534   -0.6030   -1.0657   -0.7267
   KURTOSIS (G2)   0.9893   -0.5219   -0.3753    1.0844   -0.2081
   LOWER  5%       0.1858    0.1131    0.1320    0.1077    0.0963
   UPPER  5%       0.2698    0.1575    0.1851    0.1344    0.1144
```

P. Bugs that have been fixed in EQS 5.7

(1) Fail to access a data file specified in EQS model

EQS can read a data file name up to 60 characters in length (including the path name). There were situations in which the program complained that a file could not be found, even if the length of the data file was within 60 characters. The problem was caused by a bug that has been corrected.

(2) Correct a fixed covariance in Diagrammer

BUILD_EQS failed to build a covariance in an EQS model if this covariance was a fixed parameter. This problem has been corrected.