

# Chapter 5

## Creating Graphs

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# Chapter 5

## Creating Graphs

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### Introduction

In the Analyst Application, you can use bar charts, pie charts, and scatter plots, in addition to other kinds of graphs, to display your data graphically. Vertical and horizontal bar charts display your data in the form of a two-dimensional or three-dimensional bar graph. A pie chart displays your data in the form of a two-dimensional or three-dimensional disc, divided into slices. The size of each slice indicates the relative contribution of each part to the whole. A scatter plot displays any relationship between two or more variables.

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### Bar Charts

To create a bar chart, select **Graphs** → **Bar Chart**. Select **Horizontal . . .** or **Vertical . . .** to create a horizontal or a vertical bar chart.

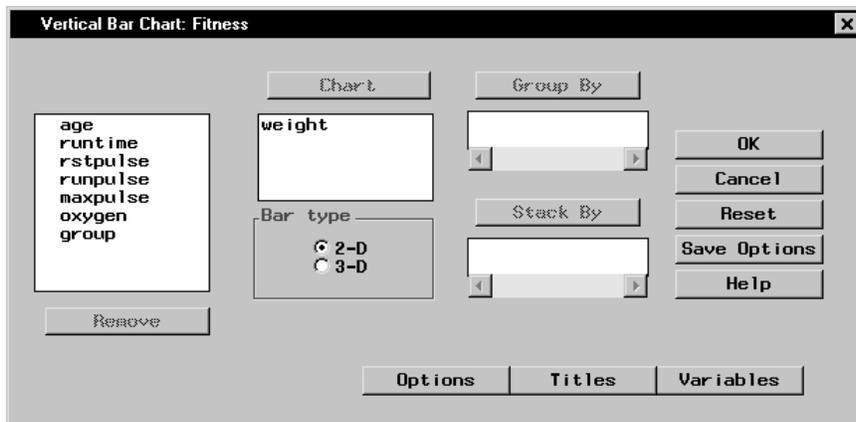


Figure 5.1. Vertical Bar Chart Dialog

Select variables from the candidate list and click on the **Chart** button to create bar charts of those variables.

Select **2-D** or **3-D** under **Bar type** to specify whether you want to display a two-dimensional or a three-dimensional chart.

Select a variable from the candidate list and click on the **Group By** button to add the variable to be used as a grouping variable in the bar chart. This organizes the bars into groups based on the values of the grouping variable.

Select a variable from the candidate list and click on the **Stack By** button to add the variable to be used as a stacking variable in the bar chart. Using a stacking variable subdivides, or stacks segments of, each bar based on the contribution of the stacking variable.

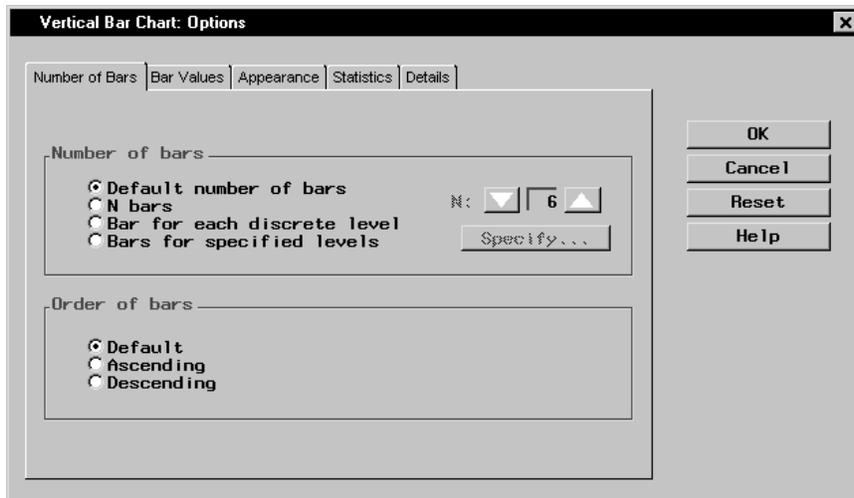
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## Bar Chart Options

Click on the **Options** button to display the Bar Chart Options dialog. In the Bar Chart Options dialog, you can control the appearance of your horizontal or vertical bar chart. Click **OK** to save your changes.

### **Number of Bars**

The **Number of Bars** tab enables you to specify the number of bars in the chart and the order in which they are displayed.



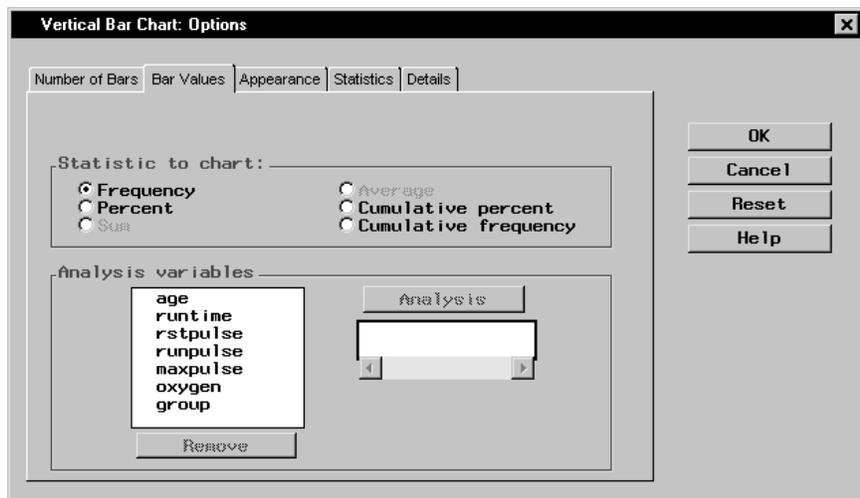
**Figure 5.2.** Number of Bars Tab

Select **Default number of bars** to display a default number of bars based on the chart variable. Select **N bars** and select a number from the list to specify the number of bars to be displayed. Select **Bar for each discrete level** to display a bar for each discrete level of the chart variable. If there is only one chart variable, select **Bars for specified levels** and click on the **Specify** button to provide a list of midpoints or to specify a range of numeric values, or to provide a list of character values.

Under **Order of bars**, select **Default**, **Ascending**, or **Descending** to display your data in default order, ascending order of bar length, or descending order of bar length.

### **Bar Values**

The **Bar Values** tab enables you to control the type of information that is displayed by each bar by specifying the statistic to display in the chart and any additional variable to use in computing the statistic.



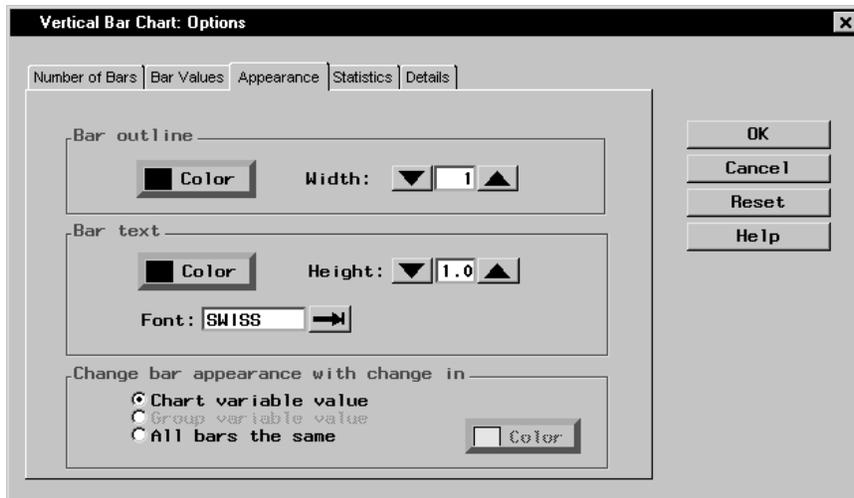
**Figure 5.3.** Bar Values Tab

If you do not specify an analysis variable, you can select frequency, percent, cumulative percent, or cumulative frequency as the statistic to chart. Each bar represents the selected statistic for the current midpoint value of the chart variable.

If you specify an analysis variable, you can select sum or average as the statistic to chart. Each bar displays the sum or average of the analysis variable for the current midpoint value of the chart variable.

### **Appearance**

The **Appearance** tab enables you to select colors and fonts.



**Figure 5.4.** Appearance Tab

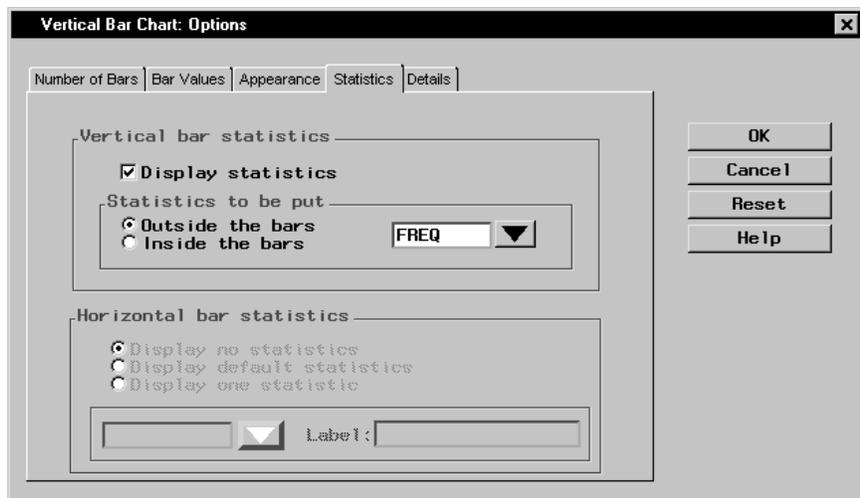
Under **Bar outline**, click on the **Color** button and select a color for the outline of the bar from the Color Attributes dialog. Specify the width of the bar outline in pixels in the **Width:** selector.

Under **Bar text**, click on the **Color** button and select a color for the chart text from the Color Attributes dialog. Specify the height of the text in cells in the **Height:** selector. Select a font by clicking on the arrow next to the **Font:** selector.

Under **Change bar appearance with change in**, you can track changes in the chart or group variable values by color, or you can choose to have all bars remain the same color. If you choose **All bars the same**, you can specify the color to be used.

### **Statistics**

The **Statistics** tab enables you to specify the display of statistics in horizontal and vertical bar charts.



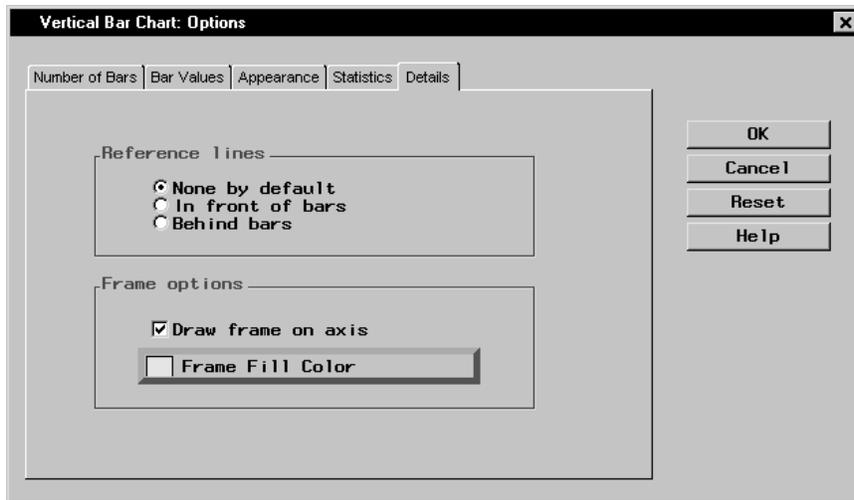
**Figure 5.5.** Statistics Tab

If the chart is a vertical bar chart, the **Vertical bar statistics** section is clickable and the **Horizontal bar statistics** section is greyed. Select **Display statistics** if you want statistics to be displayed in the chart, and specify whether the statistics should be displayed inside or outside the bars of the chart. Select the statistic to be displayed from the list.

If the chart is a horizontal bar chart, the **Horizontal bar statistics** section is clickable and the **Vertical bar statistics** section is greyed. Select **Display no statistics** to hide statistics from display. Select **Display default statistics** to display the statistics that have been applied to the chart. To display one statistic, select **Display one statistic**, and select the statistic to be displayed from the list.

### **Details**

The **Details** tab enables you to specify reference lines and frame options.



**Figure 5.6.** Details Tab

Under **Reference lines**, you can select whether to display no reference lines, or display reference lines in front of or behind the bars in the chart.

Under **Frame options**, when you select **Draw frame on axis**, you can click on the **Frame Fill Color** button and select a color for the frame from the Color Attributes dialog.

---

## Bar Chart Titles

Click on the **Titles** button to display the Titles dialog.



**Figure 5.7.** Titles Dialog, Bar Chart Tab

In the **Global** tab, you can specify titles that are displayed on all output. These titles are saved across Analyst sessions.

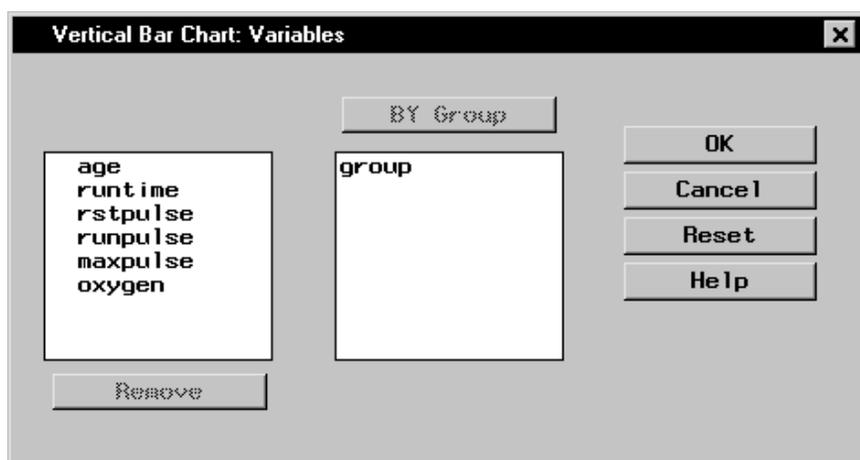
In the **Bar Chart** tab, you can specify titles for the bar chart. Select the box next to **Override global titles** to exclude the global titles from the bar chart results.

In the **Settings** tab, you can specify whether or not to include the date, the page numbers, and a filter description.

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## Bar Chart Variables

Click on the **Variables** button to display the Bar Chart Variables dialog.



**Figure 5.8.** Vertical Bar Chart: Variables Dialog

BY group variables separate the data set into groups of observations. Separate analyses are performed for each group and displayed in separate charts. For example, you could use a BY group variable to perform separate analyses on females and males. Specify BY group variables by selecting them in the candidate list and clicking on the **BY Group** button.

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## Example: Create a 3-D Bar Chart

### *Open the Fitness Data Set*

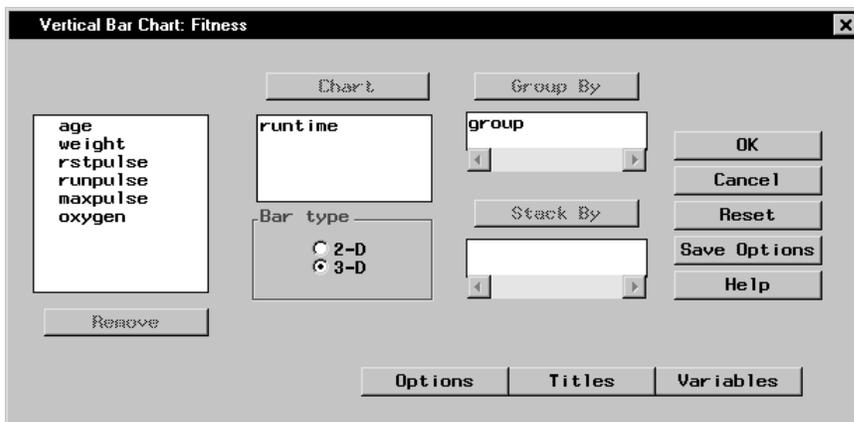
In this example, you create a bar chart using the Fitness data set. To open the Fitness data set, follow these steps:

1. Select **Tools** → **Sample Data** . . .
2. Select **Fitness**.
3. Click **OK** to create the sample data set in your **Sasuser** directory.
4. Select **File** → **Open By SAS Name** . . .
5. Select **Sasuser** from the list of **Libraries**.
6. Select **Fitness** from the list of members.
7. Click **OK** to bring the Fitness data set into the data table.

### *Specify Chart and Grouping Variables*

To create a 3-D vertical bar chart that compares among experimental groups the average amount of oxygen consumed given the time it takes to run 1.5 miles, follow these steps:

1. Select **Graphs** → **Bar Chart** → **Vertical** . . . to display the Vertical Bar Chart dialog.
2. Select **runtime** from the candidate list, and click **Chart** to make minutes to run 1.5 miles the charted variable.
3. Under **Bar type**, select **3-D** to make the bar chart three-dimensional.
4. To compare among experimental groups, select **group** from the candidate list and click **Group By**.



**Figure 5.9.** Chart and Grouping Variables

### **Specify Bar Chart Options**

To specify your bar chart options, such as the number and appearance of the bars, follow these steps.

1. Click on the **Options** button to display the Bar Chart Options dialog.
2. Under **Number of bars**, select **N bars**, and click on the down arrow until **N** = 3. Because a grouping variable was specified, bars for three runtime midpoints are displayed for each value of the experimental group.

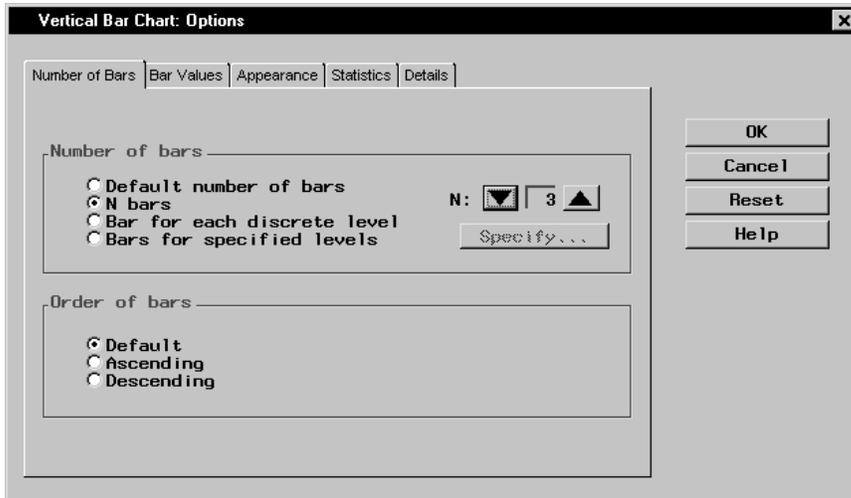


Figure 5.10. Number of Bars

3. Select the **Bar Values** tab. Under **Analysis variables**, select **oxygen** from the candidate list and click on the **Analysis** button to make oxygen consumption your analysis variable.
4. Under **Statistic to chart**, select **Average** to display the average oxygen consumption per runtime.

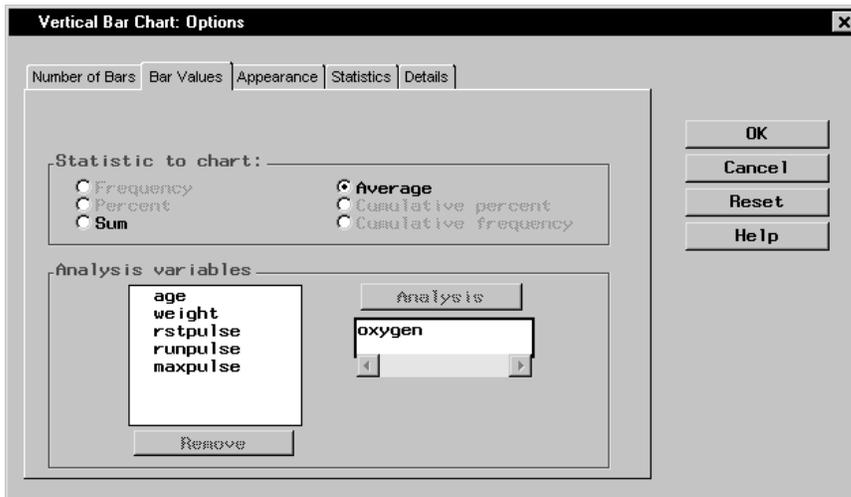
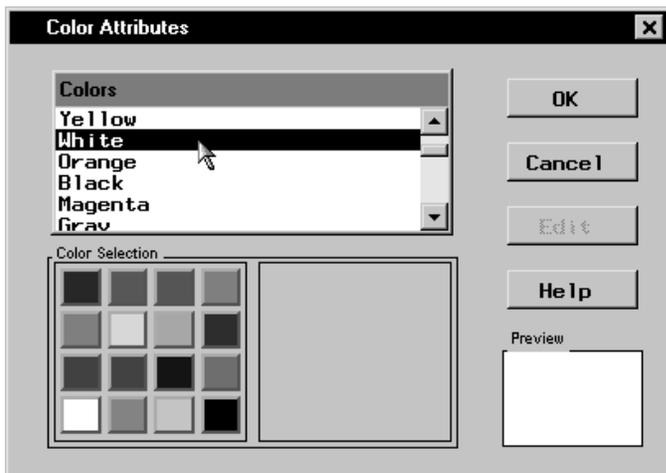


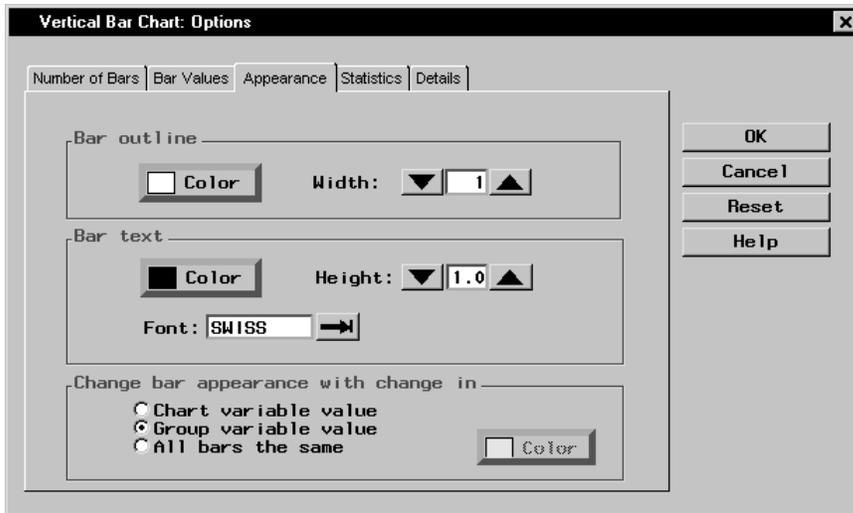
Figure 5.11. Bar Values

5. Select the **Appearance** tab. Under **Bar outline**, click on the **Color** button. Select **White** from the Color Attributes list to make the bar outlines white.



**Figure 5.12.** Bar Outlines

- Click **OK** to close the Color Attributes window and return to the Bar Chart Options dialog.
6. Still on the **Appearance** tab, select **Group variable value** under **Change bar appearance with change in**.



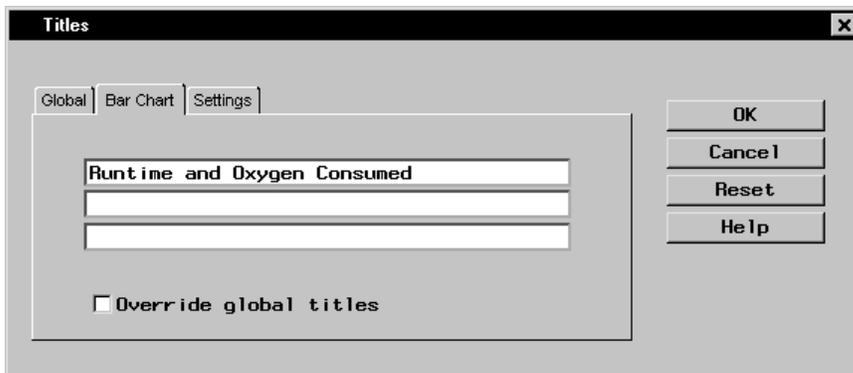
**Figure 5.13.** Bar Appearance

7. Click **OK** to return to the Vertical Bar Chart dialog.

### **Specify Bar Chart Titles**

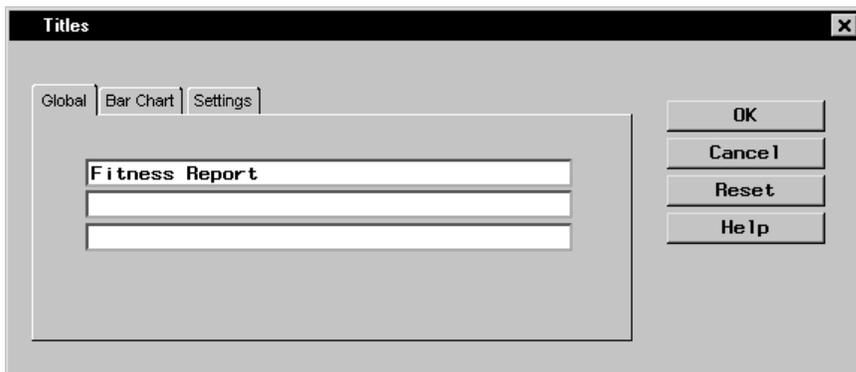
To specify the titles for your bar chart, follow these steps:

1. Click on the **Titles** button in the Vertical Bar Chart dialog.
2. In the **Bar Chart** tab, type **Runtime and Oxygen Consumed** in the first field.



**Figure 5.14.** Bar Chart Title

3. Click on the **Global** tab. Type **Fitness Report** in the first field. This global title is saved across all Analyst sessions until you change it.

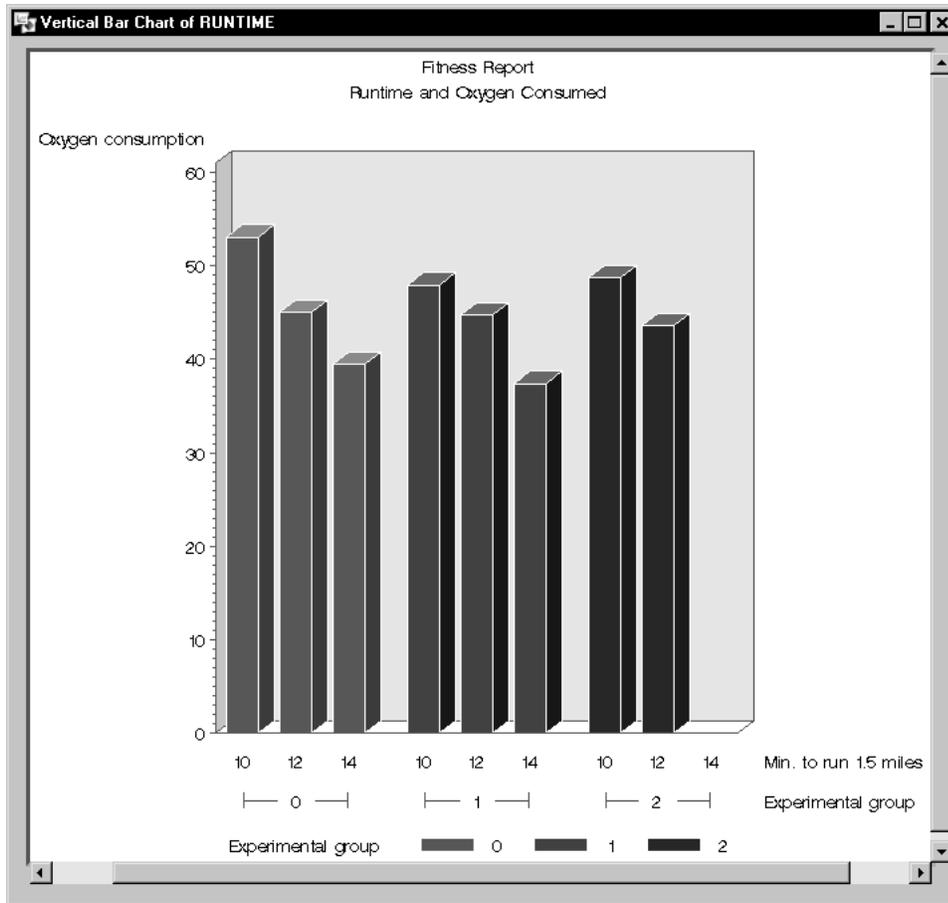


**Figure 5.15.** Global Title

4. Click **OK** to save your title changes.

### **Generate Bar Chart**

To display your bar chart, click **OK** in the Vertical Bar Chart dialog.

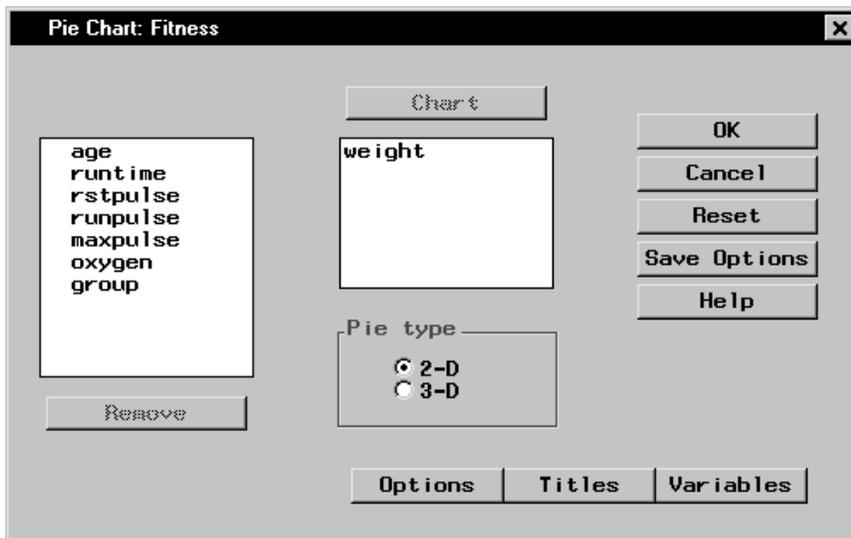


**Figure 5.16.** Vertical Bar Chart

As expected, larger amounts of oxygen are consumed by faster runners. Experimental group does not appear to affect this relationship or the average amount of oxygen consumed. No members of experimental group 2 were among the slowest runners.

## Pie Charts

To create a pie chart, select **Graphs** → **Pie Chart . . .**



**Figure 5.17.** Pie Chart Dialog

Select variables from the candidate list and click on the **Chart** button to produce a pie chart for each variable.

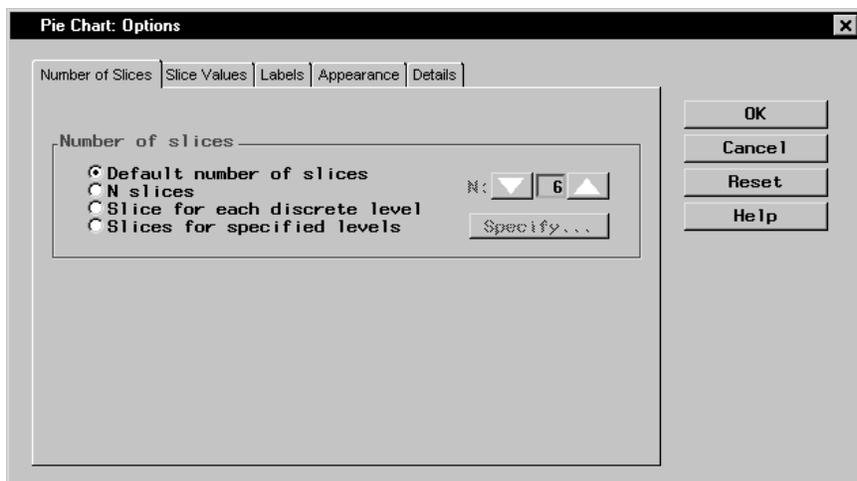
Select **2-D** or **3-D** under **Pie type** to specify whether you want to display a two-dimensional or three-dimensional chart.

## Pie Chart Options

In the Pie Chart Options dialog, you can control the appearance of your pie chart. Click on the **Options** button to display the Pie Chart Options dialog. Click **OK** to save your changes.

### **Number of Slices**

The **Number of Slices** tab enables you to specify the number of slices in the chart and the levels for which they are displayed.

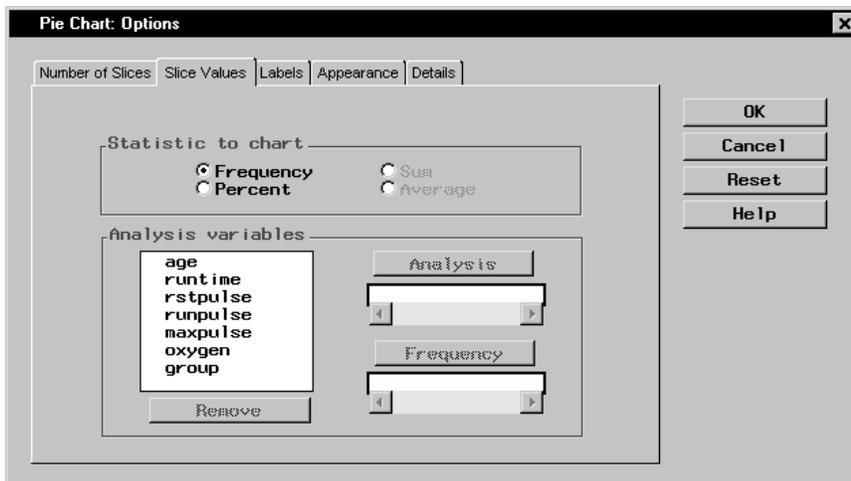


**Figure 5.18.** Number of Slice Tab

Under **Number of slices**, select **Default number of slices** to display an algorithmically determined number of slices. Select **N slices** and select a number from the list to specify the number of slices to be displayed. Select **Slice for each discrete level** to display a slice for each discrete level of data. If you are charting no more than one variable, select **Slices for specified levels** and click on the **Specify** button to provide a list of midpoints or to specify a range of numeric values, or to provide a list of character values.

### **Slice Values**

The **Slice Values** tab enables you to control the type of information that is displayed by each slice by specifying the statistic to display in the chart and any additional variable to use in computing the statistic.



**Figure 5.19.** Slice Values Tab

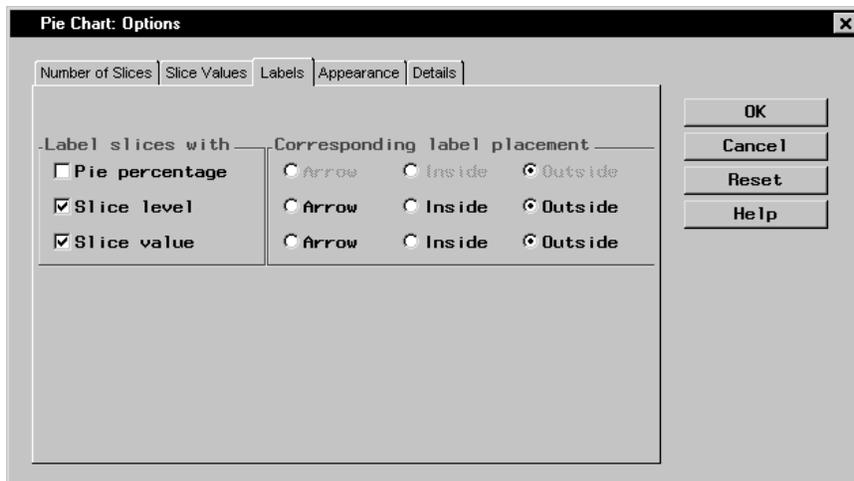
Selecting **Frequency** under **Statistic to chart** causes each slice to represent the frequency with which a value or range of values occurs for the chart variable. Selecting **Percent** causes each slice to represent the percentage of observations of the chart variable having a given value or falling into a given range.

If you want to show some characteristic of an additional variable for each level of the chart variable, select the additional variable as an **Analysis** variable. Then you can select **Sum** or **Average** of the analysis variable as the statistic to compute and display in each slice.

Select a **Frequency** variable if each observation in the data set represents several real observations, with values of the frequency variable indicating that number.

### **Labels**

The **Labels** tab enables you to define the labels for the slices in the pie chart.



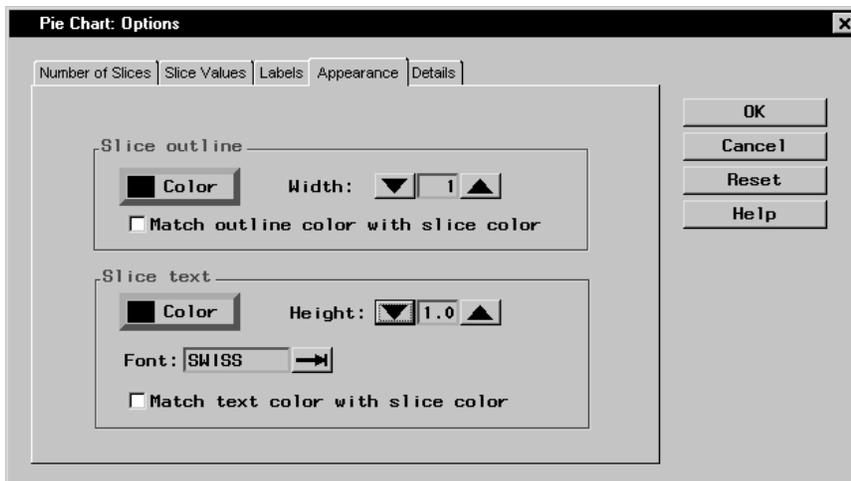
**Figure 5.20.** Labels Tab

Under **Label slices with**, you can choose to label the slices with their percentage of the pie chart, the level of the slice, and the value of the slice.

Under **Corresponding label placement**, you can place each of the labels inside or outside the slice, or you can include an arrow that points from the label to the slice.

### **Appearance**

The **Appearance** tab enables you to select colors, fonts, and line width.



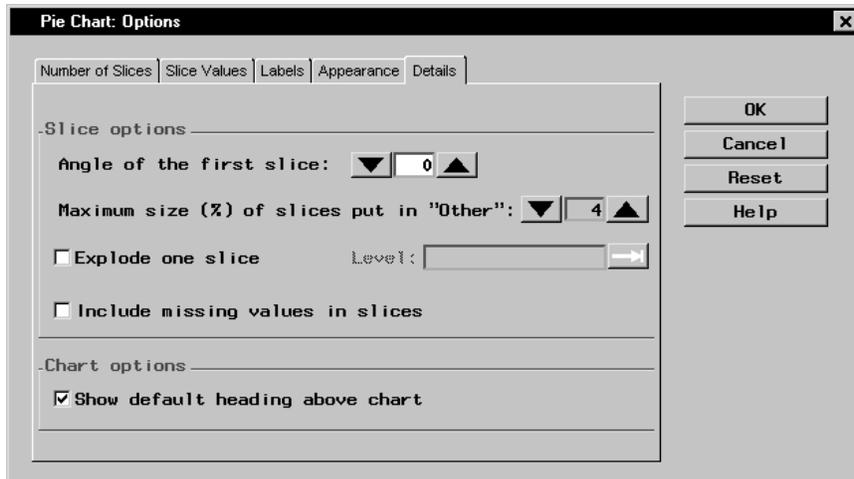
**Figure 5.21.** Appearance Tab

Under **Slice outline**, select the check box if you want the outline of each slice to be the same as the slice color. You can also control the width of the slice outlines. To select one color to be used for all outlines, click on the **Color** button and select a color from the Color Attributes dialog.

Under **Slice text**, select the check box if you want to match the color of the text with the color of the slice. You can also control the height and font of the slice text. To select one color to be used for all text, click on the **Color** button and select a color from the Color Attributes dialog.

### **Details**

The **Details** tab enables you to specify slice and chart heading options.



**Figure 5.22.** Details Tab

Under **Slice options**, you can specify the angle in degrees of the first slice by clicking on the up or down arrows or by typing in the degree. You can also define the maximum percentage size of slices you want to gather into an **Other** category by clicking on the arrows to choose from a range of one to fifteen percent. If you are charting one variable, you can select **Explode one slice**, and type in the level. If you have selected **Slice for each discrete level** or **Slices for specified levels** in the **Number of Slices** tab, you can click on the arrow next to **Level:** to select from a range of levels.

You can choose to include missing values in slices.

Under **Chart options**, you can select **Show default heading above chart** to include a heading that summarizes what the chart displays.

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## Pie Chart Titles

Click on the **Titles** button to display the Titles dialog.

In the **Global** tab, you can specify titles that are displayed on all output. These titles are saved across Analyst sessions.

In the **Pie Chart** tab, you can specify titles for the pie chart. Select the box next to **Override global titles** to exclude the global titles from the pie chart results.

In the **Settings** tab, you can specify whether or not to include the date, page numbers, and a filter description.

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## Pie Chart Variables

Click on the **Variables** button to display the Pie Chart Variables dialog.

BY group variables separate the data set into groups of observations. Separate analyses are performed for each group, and a separate chart is displayed for each analysis. For example, you could use a BY group variable to perform separate analyses on females and males. Specify BY group variables by selecting them in the candidate list and clicking on the **BY Group** button.

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## Example: Create a 3-D Pie Chart

### *Open the Fitness Data Set*

In this example, you create a pie chart from the **Fitness** data set. If you have not already done so, open the **Fitness** data set by following these steps:

1. Select **Tools** → **Sample Data** . . .
2. Select **Fitness**.
3. Click **OK** to create the sample data set in your **Sasuser** directory.
4. Select **File** → **Open By SAS Name** . . .
5. Select **Sasuser** from the list of **Libraries**.
6. Select **Fitness** from the list of members.
7. Click **OK** to bring the **Fitness** data set into the data table.

### Specify Pie Chart Variable

To specify the variable to be charted and the chart type, follow these steps:

1. Select **Graphs** → **Pie Chart** . . .
2. Select runtime from the candidate list, and click **Chart** to make minutes to run 1.5 miles the charted variable.
3. Select **3-D** under **Pie type** to specify a three-dimensional chart.

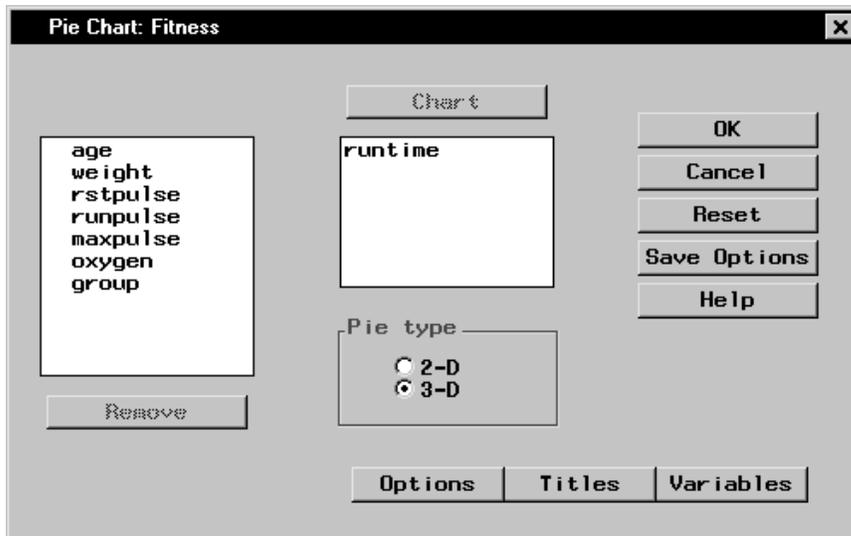
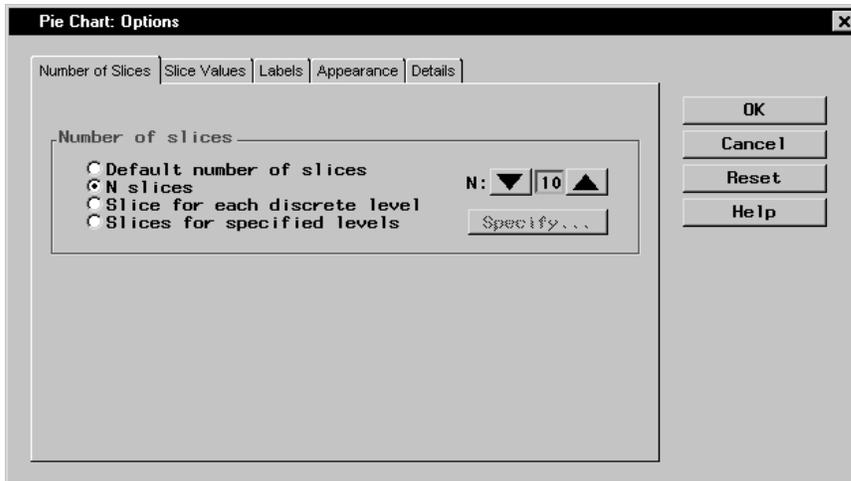


Figure 5.23. Pie Chart Variable and Type

### Specify Pie Chart Options

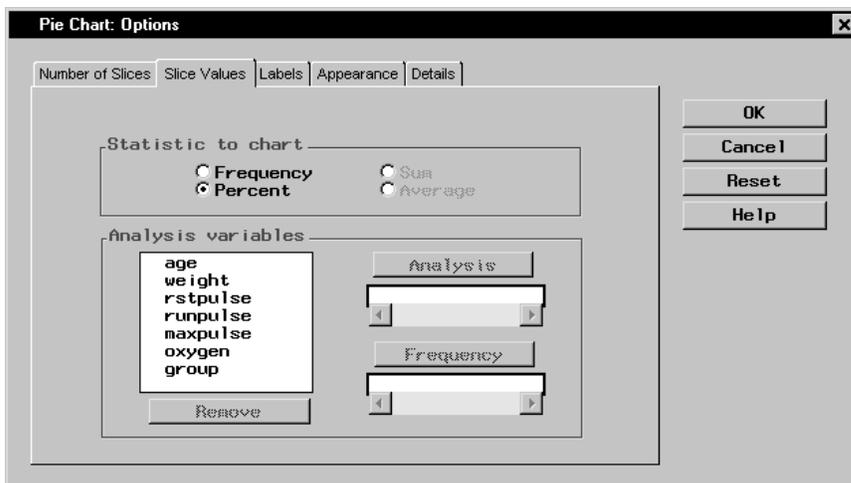
To specify your pie chart options, such as the number of slices, follow these steps:

1. Click on the **Options** button to display the Pie Chart Options dialog.
2. In the **Number of Slices** tab, design a chart with ten slices by selecting **N slices** and clicking on the up arrow until the number **10** is visible.



**Figure 5.24.** Number of Slices in Pie Chart

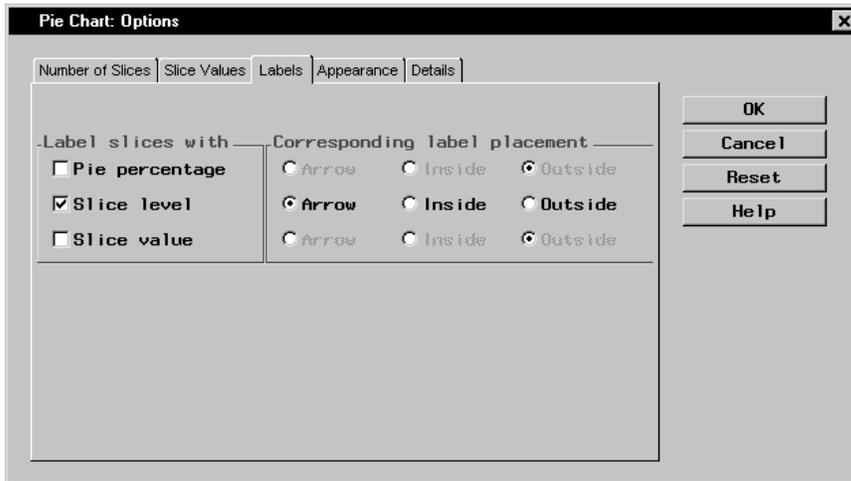
3. In the **Slice Values** tab, select **Percent** under **Statistic to chart** in order to chart the percentage of each runtime in relation to the whole.



**Figure 5.25.** Statistic to Chart

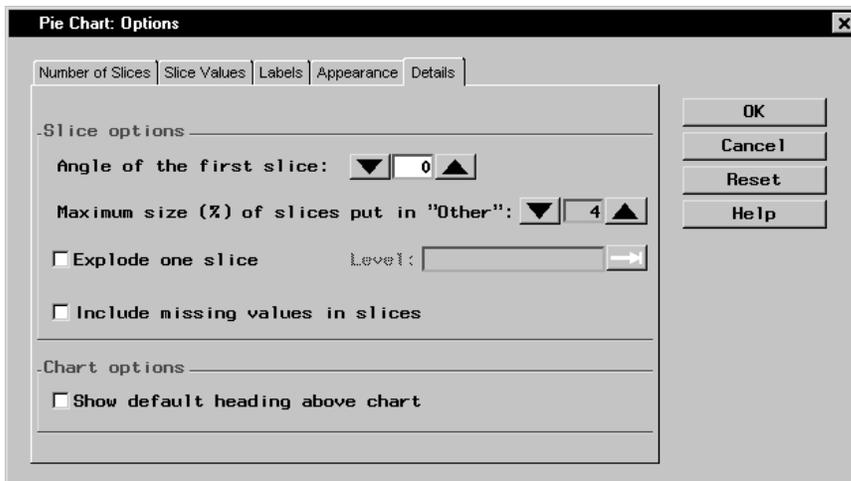
4. In the **Labels** tab, select **Slice level** under **Label slices with**. Select **Arrow** under **Corresponding label placement**. Each

slice indicates a runtime, and each label is placed outside the disc, with an arrow pointing to the corresponding slice.



**Figure 5.26.** Pie Chart Labels

5. In the **Details** tab, deselect **Show default heading above chart** under **Chart options**. You provide a new heading in the **Titles** dialog.



**Figure 5.27.** Deselect Default Heading

6. Click **OK** to save your changes and return to the Pie Chart dialog.

**Specify Pie Chart Titles**

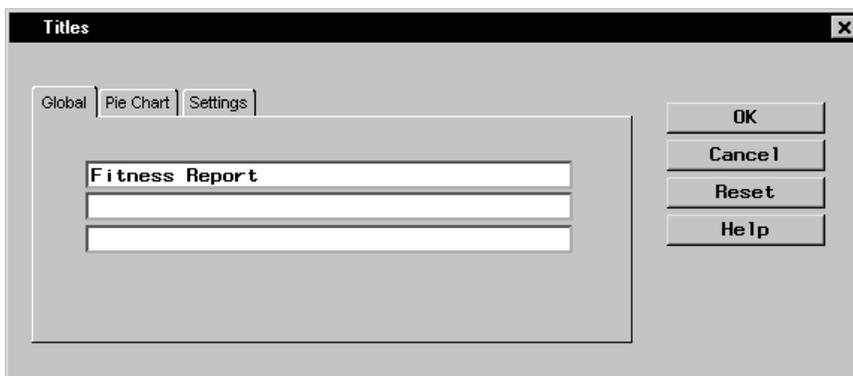
To specify the titles for your pie chart, follow these steps:

1. Click on the **Titles** button in the Pie Chart dialog.
2. In the **Pie Chart** tab, type **Percentage of Each Runtime** in the first field.



**Figure 5.28.** Pie Chart Title

3. If you did not change the global title in the first exercise in this chapter, click on the **Global** tab. Type **Fitness Report** in the first field. This global title is saved across all Analyst sessions until you change it.



**Figure 5.29.** Global Title

4. Click on **OK** to save your title changes.

### Generate Pie Chart

To display your pie chart, click **OK** in the Pie Chart dialog.

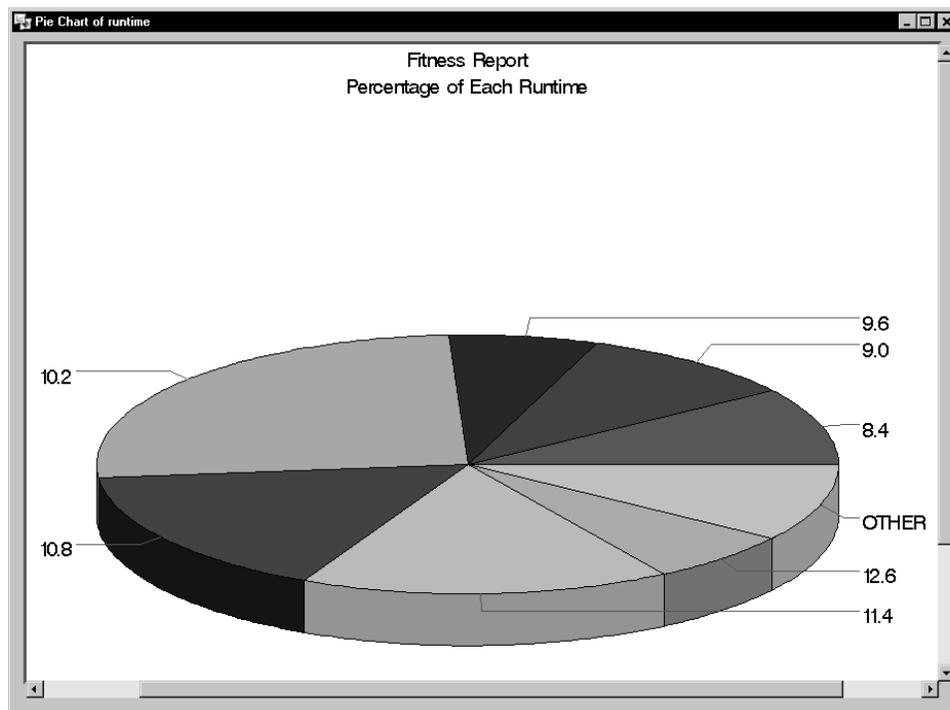
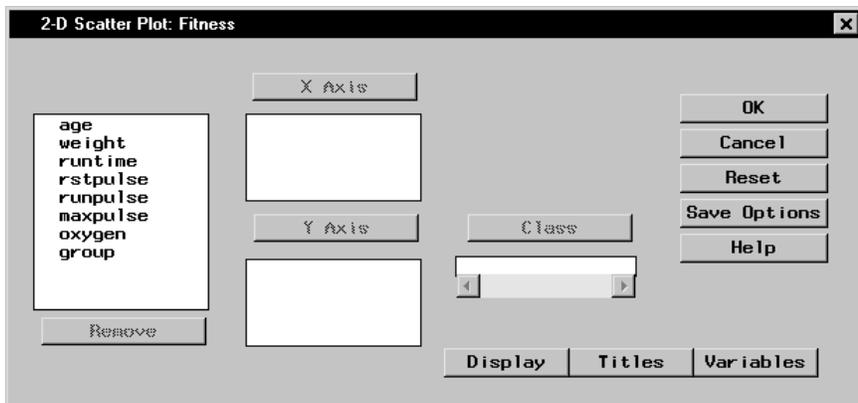


Figure 5.30. 3-D Pie Chart

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## Scatter Plots

To create a scatter plot, select **Graphs** → **Scatter Plot**. Select **Two-Dimensional ...** or **Three-Dimensional ...** to create a two-dimensional or three-dimensional scatter plot of the data in the current table.



**Figure 5.31.** 2-D Scatter Plot Dialog

If you specify more than one variable for any of the axes, one plot is produced for each combination of variables.

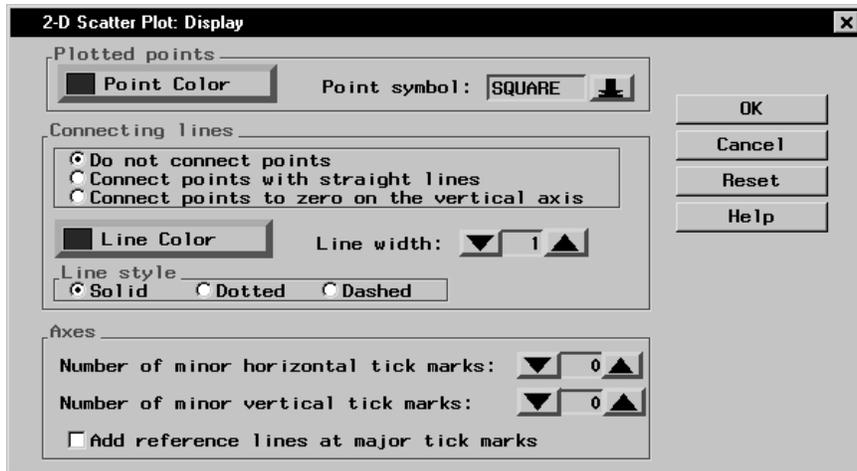
You must specify one or more  $x$ -axis variables and one or more  $y$ -axis variables. For three-dimensional plots, you must specify one or more  $z$ -axis variables.

For a two-dimensional scatter plot, specify a class variable to define subgroups. Each level of the class variable is represented by a different symbol on the scatter plot.

---

## Two-Dimensional Scatter Plot Options

In two-dimensional plots, you can specify the point color and connecting lines as well as control the tick marks on the axes. Click on the **Display** button to specify these display options.



**Figure 5.32.** 2-D Scatter Plot: Display Dialog

Click on the **Point Color** button to choose the point color. Click on the arrow next to **Point symbol:** to choose the symbol.

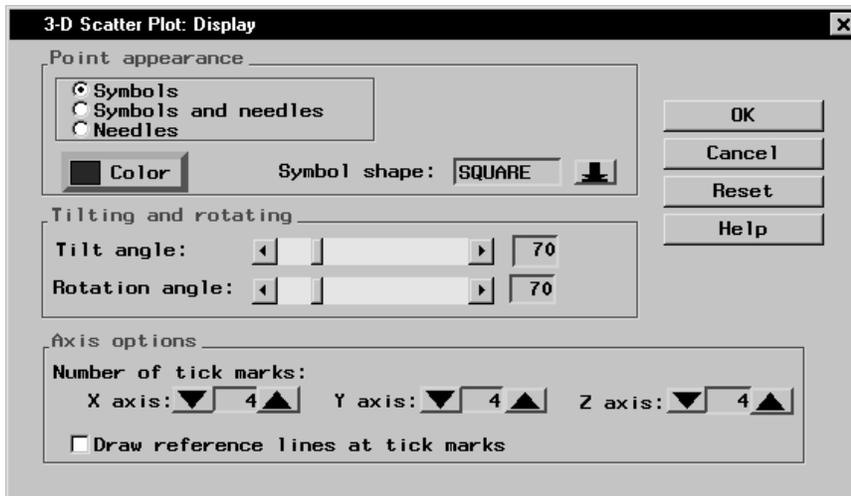
Under **Connecting lines**, specify whether the points are to be unconnected or connected to each other or the vertical axis, and specify the line color and style. Click on the **Line Color** button to specify the line color to be used for connecting points. Click on the arrows next to **Line width:** to specify the width of the line used to connect points. Under **Line style**, specify the style of the line used to connect points.

Under **Axes**, click on the up and down arrows to increase or decrease the number of minor horizontal and vertical tick marks. Select the check box to add reference lines at major tick marks.

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## Three-Dimensional Scatter Plot Options

In three-dimensional plots, you can control the appearance of the points as well as the tilt and rotation of the plot. You can also control the tick marks on the axes.



**Figure 5.33.** 3-D Scatter Plot: Display Dialog

Under **Point appearance**, specify whether the points should be represented by symbols, needles, or both. Click on the **Color** button to specify the color for point symbols and needles. Click on the arrow next to **Symbol shape**: to specify the symbol for the points.

Under **Tilting and rotating**, move the bars next to **Tilt angle**: and **Rotation angle**: to specify the tilt angle and rotation angle for the plot.

Under **Axis options**, click on the arrows to specify the number of  $x$ -axis,  $y$ -axis, and  $z$ -axis tick marks. Click on the box next to **Draw reference lines at tick marks** to request that reference lines be drawn at each tick mark.

---

## Scatter Plot Titles

Click on the **Titles** button to display the Titles dialog.



**Figure 5.34.** Titles Dialog, 3-D Scatter Plot Tab

In the **Global** tab, you can specify titles that are displayed on all output. These titles are saved across Analyst sessions.

In the **Scatter Plot** tab, you can specify titles for the scatter plot. Select the box next to **Override global titles** to exclude the global titles from the scatter plot results.

In the **Settings** tab, you can specify whether or not to include the date, the page numbers, and a filter description.

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## Scatter Plot Variables

Click on the **Variables** button to display the Scatter Plot Variables dialog.

BY group variables separate the data set into groups of observations. Separate analyses are performed for each group, and a separate plot is displayed for each analysis. For example, you could use a BY group variable to perform separate analyses on females and males. Specify BY group variables by selecting them in the candidate list and clicking on the **BY Group** button.

## Example: Create a 2-D Scatter Plot

### Open the Fitness Data Set

In this example, you use the Fitness data set as the basis of your scatter plot. If you have not already done so, open the Fitness data set by following these steps:

1. Select **Tools** → **Sample Data** . . .
2. Select **Fitness**.
3. Click **OK** to create the sample data set in your Sasuser directory.
4. Select **File** → **Open By SAS Name** . . .
5. Select **Sasuser** from the list of **Libraries**.
6. Select **Fitness** from the list of members.
7. Click **OK** to bring the Fitness data set into the data table.

### Specify Scatter Plot Variables

To specify the variables to be plotted, follow these steps:

1. Select **Graphs** → **Scatter Plot** → **Two-Dimensional** . . .
2. Select **age** from the candidate list, and click **X Axis** to make age in years the  $x$ -axis variable.
3. Select **runtime** from the candidate list, and click **Y Axis** to make minutes to run 1.5 miles the  $y$ -axis variable.

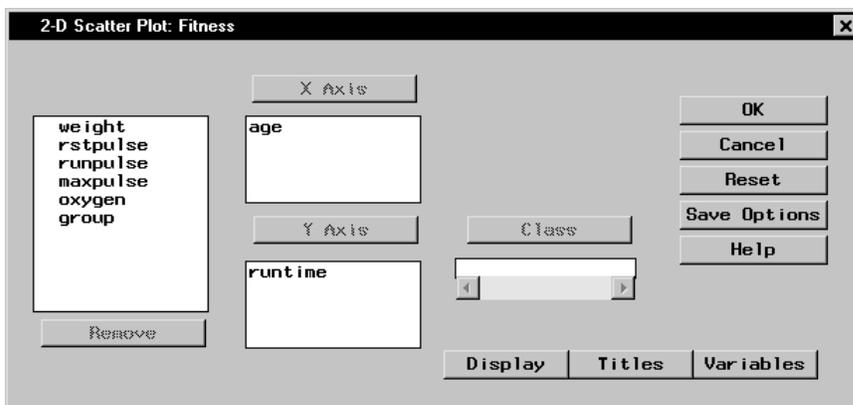
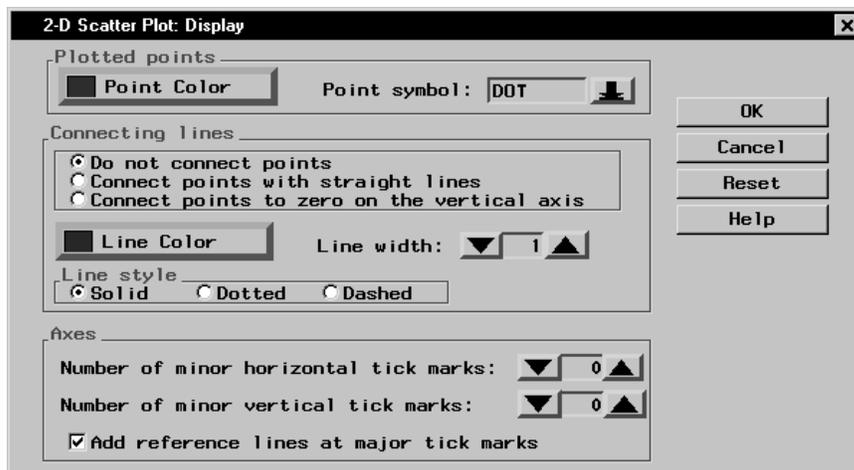


Figure 5.35. Scatter Plot Variables

### Specify Scatter Plot Display Options

To specify your scatter plot display options, follow these steps:

1. Click on the **Display** button to display the Scatter Plot Display dialog.
2. Under **Plotted points**, click on the **Point Color** button. Select **Red** from the list of colors to make your scatter plot points red. Click **OK**.
3. Click on the down arrow next to **Point symbol:** and select **DOT** from the list. This makes your scatter plot points display as dots.
4. Under **Axes**, select **Add reference lines at major tick marks**. This displays a grid on the scatter plot by which you can orient the points on the axes.



**Figure 5.36.** Display Options

5. Click **OK** to save your display changes.

### Specify Scatter Plot Titles

To specify the titles for your scatter plot, follow these steps:

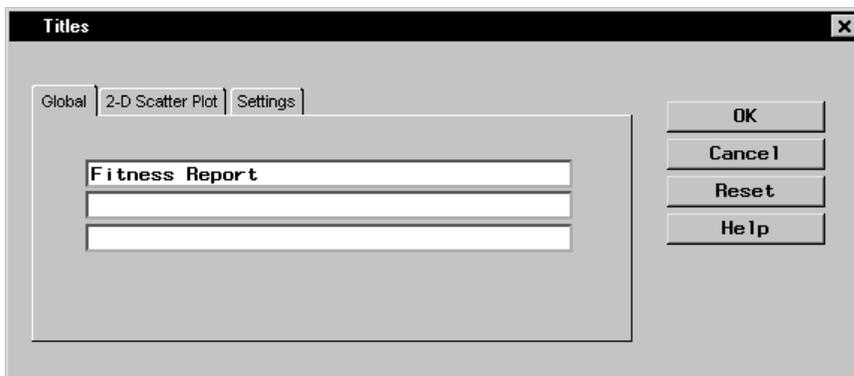
1. Click on the **Titles** button in the Scatter Plot dialog.

2. In the **Scatter Plot** tab, type **Age versus Runtime** in the first field.



**Figure 5.37.** Scatter Plot Title

3. If you did not change the global title in the first exercise in this chapter, click on the **Global** tab. Type **Fitness Report** in the first field. This global title is saved across all Analyst sessions until you change it.



**Figure 5.38.** Global Title

4. Click **OK** to save your title changes.

### **Generate Scatter Plot**

To display your scatter plot, click **OK** in the Scatter Plot dialog.

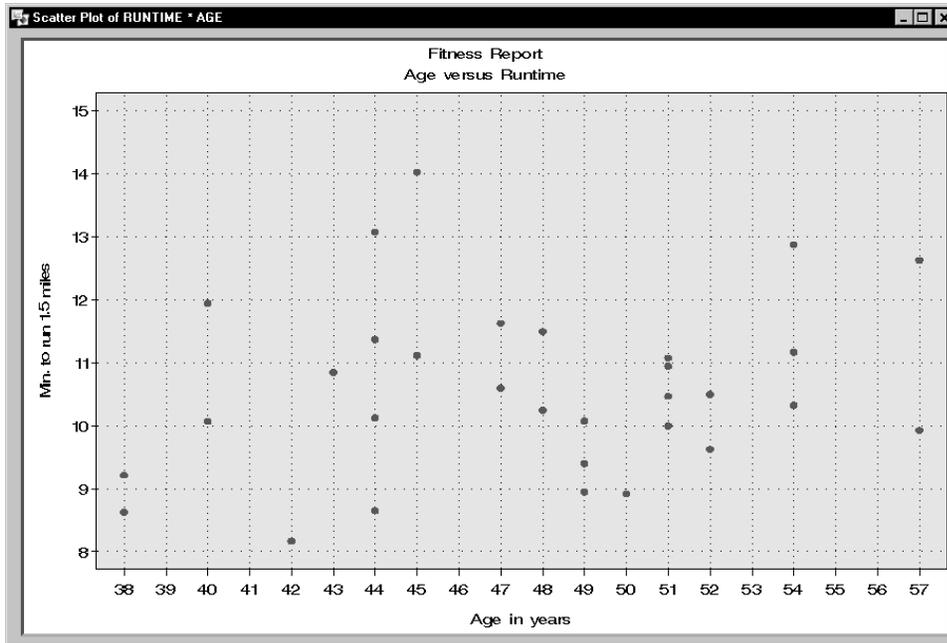


Figure 5.39. 2-D Scatter Plot

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