GraphPad Prism 8 User Guide

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This is one of three companion guides to GraphPad Prism 6.
All are available as web pages on graphpad.com.

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1 How to learn Prism

Browse the Statistics and Regression guides

This Prism Guide is only one of three guides. Check out the other two. Both do more than explain how to use Prism. They also explain the concepts of data analysis.

- GraphPad Statistics Guide
- GraphPad Curve Fitting Guide

Step by step tours

Read this one page tour 104, which will take about five minutes to follow.

Then follow longer detailed tours that walk you step by step through data analyses and graphing.

Work with tutorial data sets

Choose these from the Welcome (File..New) dialog. After choosing one of the eight kinds of tables, choose "Start with sample data to follow a tutorial". Each sample data set comes with brief instructions, and links to longer explanations.

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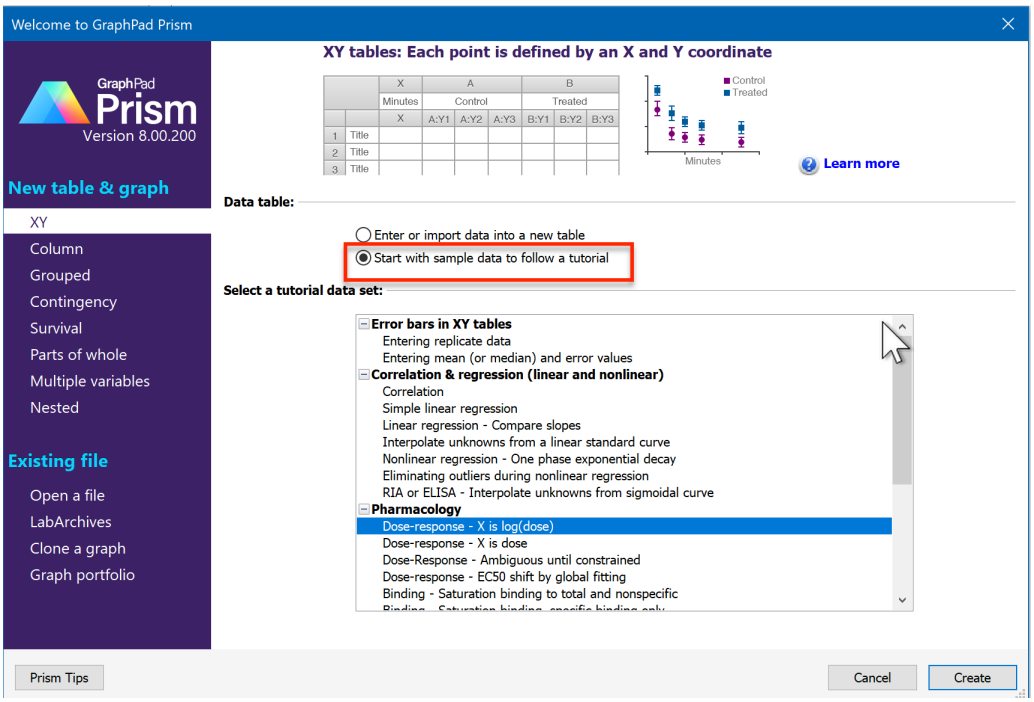

Descriptive statistics

Column statistics

Frequency distribution

Compare two groups

Unpaired t test from raw data

Paired t test

Mann-Whitney test

Wilcoxon matched pairs test

Categorical outcomes

Contingency table analysis

Survival analysis

Diagnostic lab tests

ROC curve

Bland-Altman plot

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Nonlinear regression

Fitting an enzyme kinetics curve

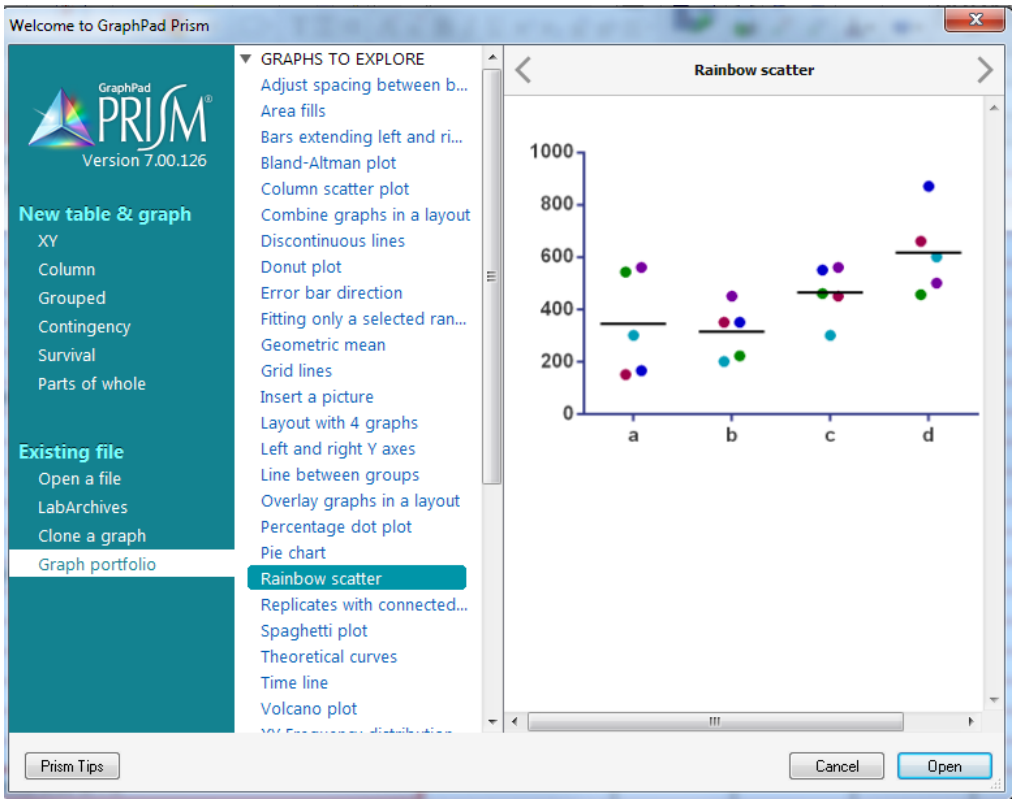
Comparing two enzyme kinetics models

Automatic outlier elimination (exponential decay)

Global nonlinear regression (dose-response curves)

Ambiguous fit (dose-response)

Explore the graph portfolio



Choose the Portfolio tab at the bottom of the Welcome (File..New) dialog to browse dozens of polished graphs, each of which demonstrates several Prism features. When you open a portfolio graph, you'll see a brief explanation of how that graph was made, and can explore the details. Many of these portfolio graphs are linked to step-by-step instructions. Others give brief explanations. Exploring these files will help you master graphing with Prism.

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2 What's new in Prism 8?

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2.1 What do you need to know before starting?

Prism is still Prism

Prism works as it always did. If you know Prism 6 or 7, you can discover most of the new features as you use Prism. It won't be hard to adjust. But there are four things you should know before you start.

Switch between analysis pages using analysis tabs

Many analyses in Prism present results on multiple pages (sometimes called subpages or views). With earlier versions of Prism, you would navigate between them using subpages indented under the analysis name in the navigator. The Prism 8 navigator does not show subpages. Instead, they are shown as analysis tabs above the results. The results on some tabs are designed for graphing, not viewing. These are hidden by default but can be shown using the drop down menu.

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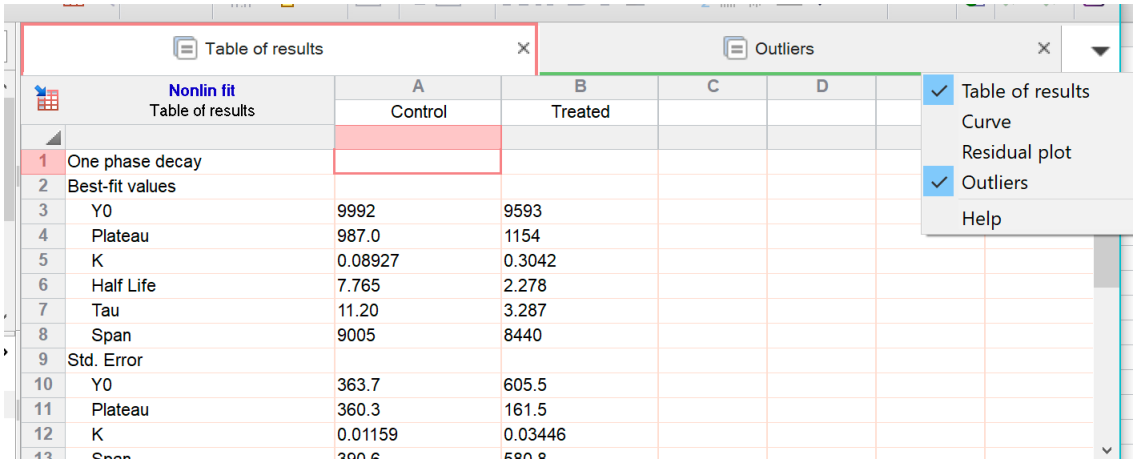
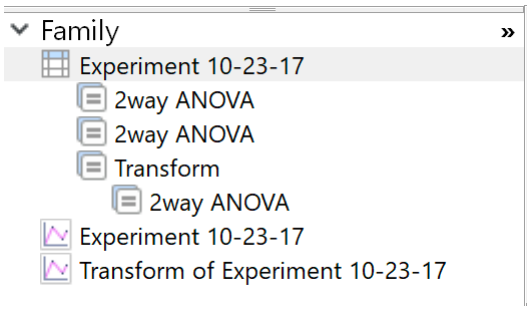


New family pane at the bottom of the navigator

The navigator in Prism 8 always shows a panel showing the family of sheets related to the current sheet, making it easier to move among related sheets. This replaces the old Family folder, which few people used. Chains of analyses are automatically indented, replacing the old Data+Results folder.



The complicated column statistics analysis has been split into three focused analyses

The column statistics analysis was complicated because it combined distinct analyses in one complicated dialog. Prism 8 makes things easier by offering three focussed analyses: Descriptive statistics, Normality (and lognormality) testing, and one-sample t test (and Wilcoxon) tests.

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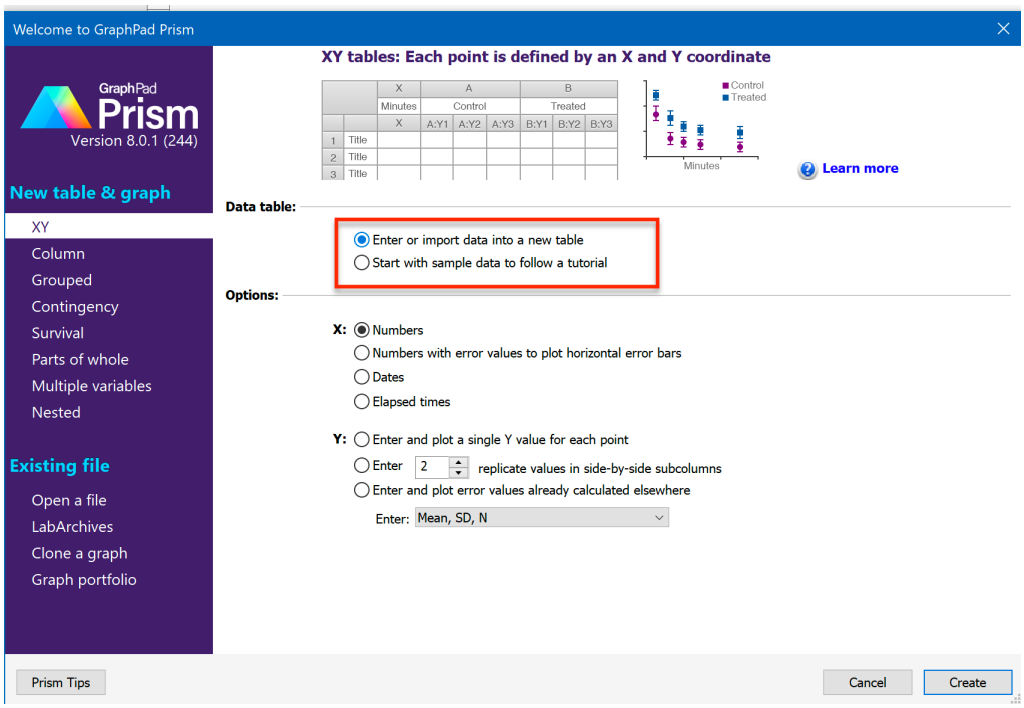
The Welcome dialog has a new explicit choice for starting with tutorial data or with a blank table

Prism 7 and earlier mixed the choices for starting with a blank table or with tutorial data in a sometimes long set of choices. Prism 8 is more explicit. You need to first choose to begin with a blank table or tutorial data. When you first use Prism 8, it will be set to show you a list of tutorial data sets. You need to make an explicit choice to start with a blank table.



Windows only: No more child windows in parent windows

With prior versions of Prism for Windows, there was one master (parent) window that could contain multiple child windows each with its own project file. With a trick, you could create two separate parent windows.

With Prism 8 Windows, the concept of parent or master window is gone. Each open file has its own window. This is the modern way of working (which almost all applications use) and makes it much easier to work with multiple displays. But it is a change, and may take a while to get used to.

Prism Mac always showed each open file in its own window, so there is no change with Prism 8.

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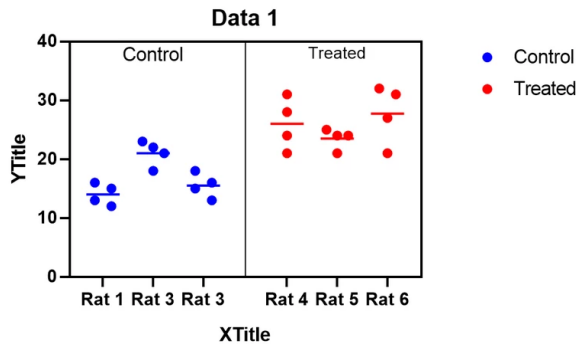
2.2 More kinds of graphs

Subcolumn graphs

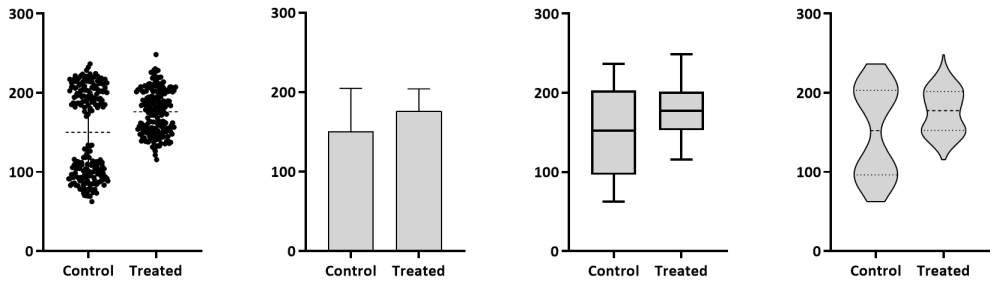
Prism 8 offers a new kind of data table for **nested data** where values stacked in each subcolumn are related, and creates subcolumn **graphs** of these data. In this example, there are two treatments given to three rats each and the outcome variable was measured four times in each rat. Each subcolumn can be plotted as a scatterplot (below), or mean or median with error as point or bar.

	Group A			Group B		
	Teaching method A			Teaching method B		
	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6
1	21	18	35	26	38	31
2	26	25	28	34	44	41
3	33	26	32	27	34	34
4	22	24	36		45	35
5		21	38		38	38
6		25				46
7						



Violin plots

Violin plots show data distributions much more clearly than do box-whisker or bar graphs. Prism 8 can create violin plots (right graph below) of Column, Grouped or XY data.



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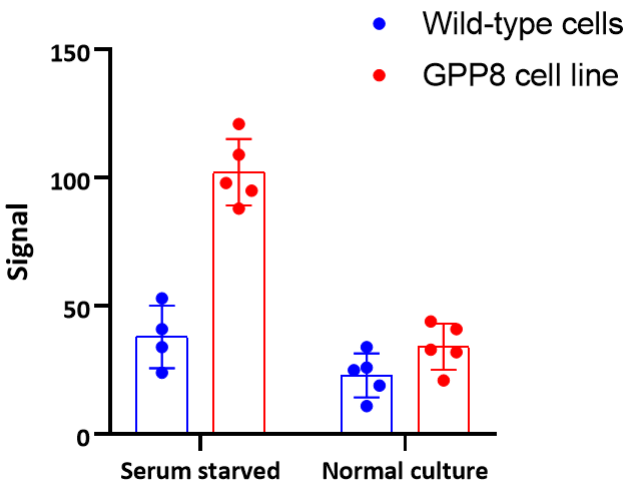
Grouped graphs that show both individual points (scatter) and bar with error bar.

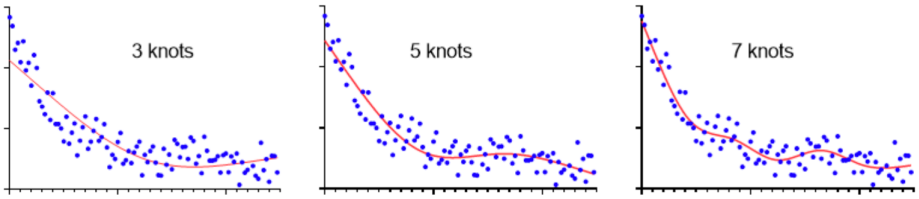
You could make the graph below in Prism 7, but only if you knew a trick. With Prism 8, it is easy.



Smoothing and Akima splines

Prism has offered a spline analysis since version 1. These spline curves went through every point, so wiggled so much they were rarely useful. Prism 8 adds two more useful forms of splines (created using the Spline analysis).

- **Smoothing splines**. These track the general trend of the data without going through every point. You choose how many "knots" to use, which controls how many inflection points the curve has.



- **Akima splines** go through every point like cubic splines, but Akima splines make tighter turns so look better in many situations.

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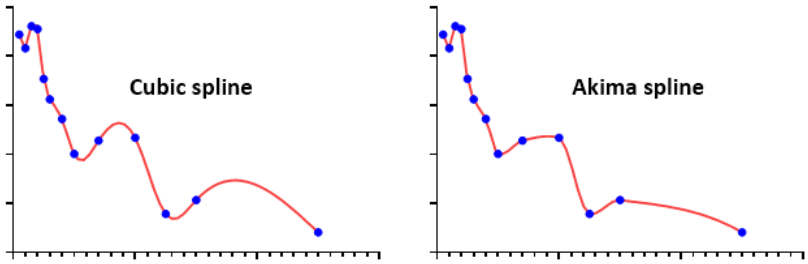
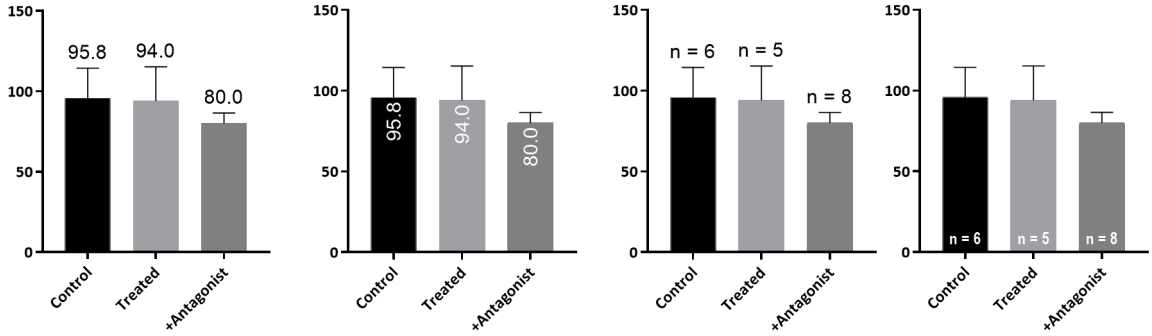


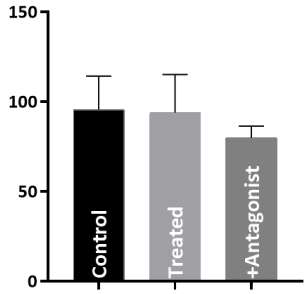
2.3 Better looking graphs

Label bar graphs

Bar graphs can include the mean, median or sample size on top, or within, the bars.

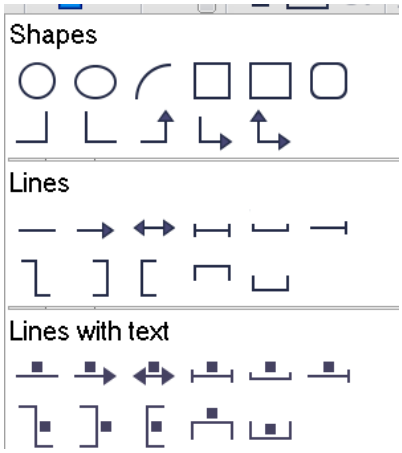


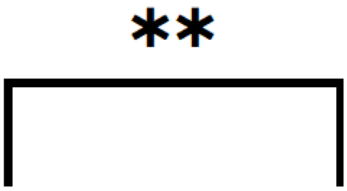
Place bar labels within the bars rather than under the bars.



It is now easier to create Grouped graphs that combine bar graphs with also plotting each point as a symbol.

Draw lines and brackets with centered text (with an easy way to write asterisks)





Scatter plots without "smiles"

Scatter graphs plot every value, moving points left or right to avoid overlap. Prism 7 sometimes ended up arranging the points in a way that created "smiles" as shown in the graph on the left below. Prism 8 (right graph below) is much smarter about this, so the graphs look better.

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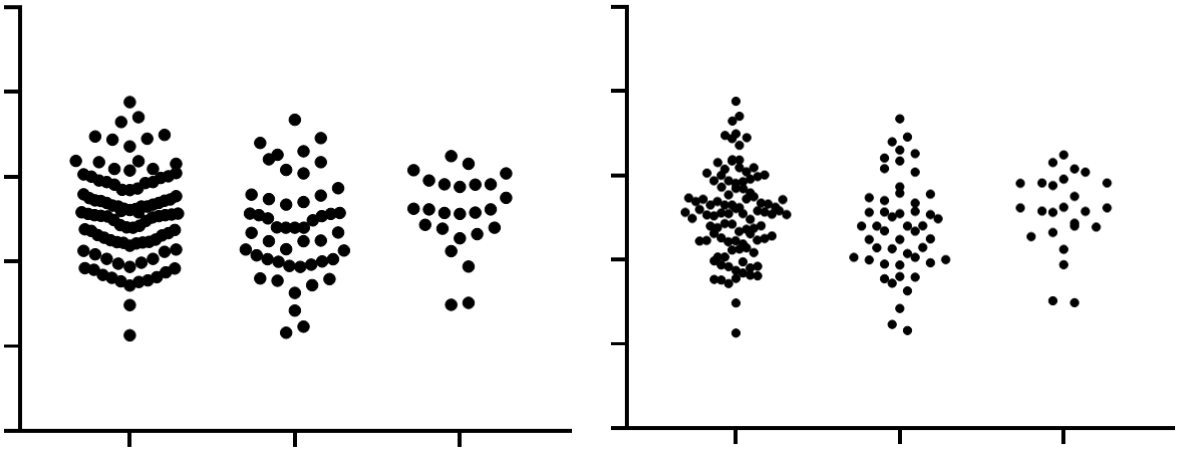

Improved importing or pasting of images

- **Crop** an image that has been imported or pasted onto a graph or layout.
- **Resize** an imported image without accidentally distorting it. Check an option to allow distortion if you really want to change the aspect ratio.
- **Import pdf and eps** images onto a graph or layout (new for Prism Windows; Prism Mac could already do this)..

Adjust color of any block of values

- Color code spaghetti graphs. Select a subcolumn of data, right click and choose a different color for those points or lines.
- Color code before-after graphs. Select range of rows in a column table, or subcolumns in a Grouped table, right click and choose a different color for those before-after points and lines. Prism 7 could do this in some cases, and Prism 8 extends this to all graphs.

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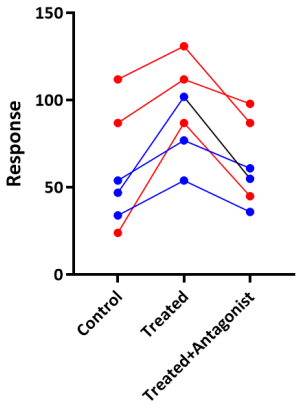
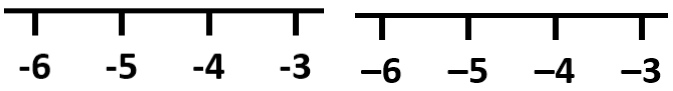


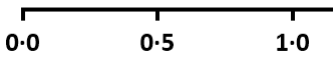
Axis numbering

- Powers-of-ten numbering on axis no longer adds silly leading zeroes. The label for when X or Y equals 5 is now 10^5 not 10^{05}.

- In preferences, choose an ordinary minus sign or a longer en-dash to show negative numbers on axis numbering.



- For axis numbering, the decimal point can be *middot*, also known as *interpunkt.* The decimal point is aligned with the middle of the digits, not their bottom. Some journals request this.



Other improvements

- Better default graphs, with more choices made automatically.
- New command to reverse the order of data sets in the legend.
- You can now add up to 100 additional ticks, grid lines and labels to an axis (Prism 7 allowed only 30).

- New choice on XY graphs to include a line of identity (used automatically for QQ plots and ROC curves)

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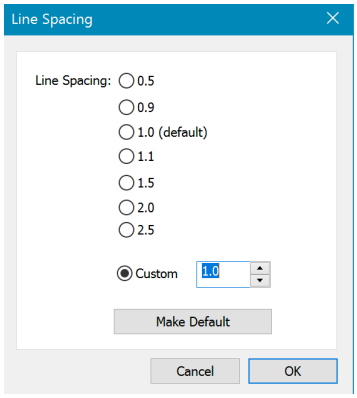
- Choose fill patterns on parts-of-whole graphs.
- Change which data set is plotted in a parts-of-whole graph.
- Choose line spacing for text objects.

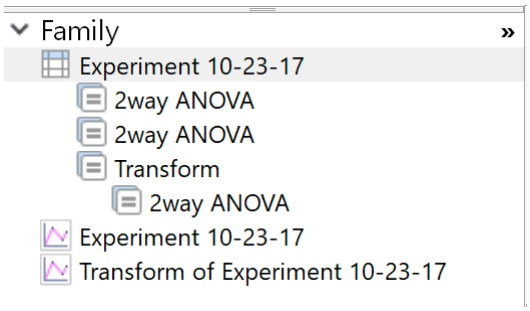


2.4 Smoother sailing

Find related sheets easily

Moving from one sheet to a linked one is a key part of working with Prism, but sometimes was too hard. The family folder was useful but had to be repeatedly reopened.

With Prism 8, the bottom of the navigator now contains a panel showing the **family of sheets** related to the current sheet. It's always there. You don't have to specially open it as you did in prior versions of Prism. Click to go to a related sheets. Chains of analyses are automatically indented, so you no longer need to open the separate Data+Results folder (which no longer is offered).



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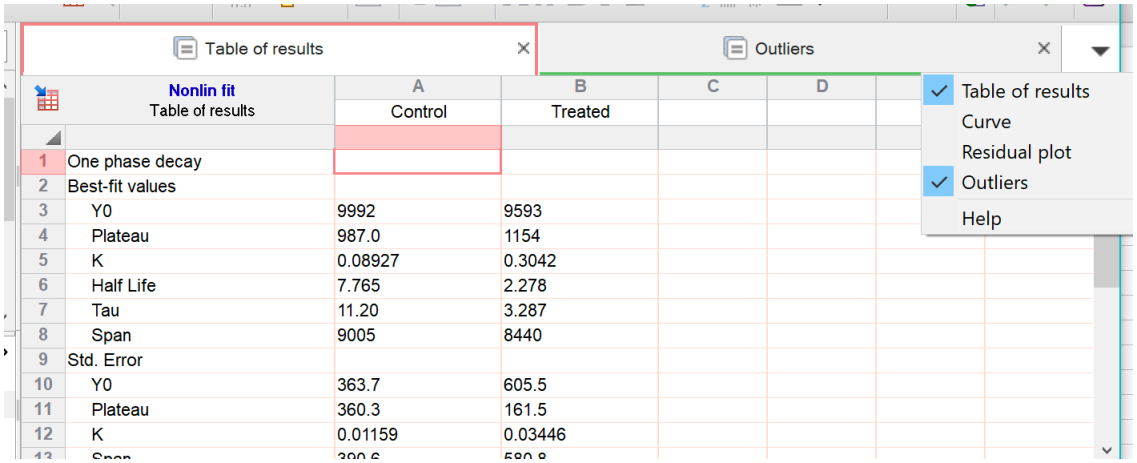
Easily jump between multiple results tables for one analysis (and hide the ones you don't want to see)

Many Prism analyses generate several tables of results. These were shown as subsheets, and all were listed -- even the ones only used to make graphs but are rarely actually looked out. Prism 8 shows the multiple results tables for an analysis as tabs across the top of the window. Results tables designed for graphing (XY coordinates of curves; residulas; QQ plots..) are hidden by default, but you can choose to view them.



Snapping that actually works

When you move one object on a graph or layout, Prism 7 tried to help by "snapping" the object you are moving into alignment with other objects on the page. However, this was sometimes more of a hindrance than a help. The problem was that Prism would sometimes try to snap to an object you are moving away from.

For Prism 8, we've totally revamped snapping so only tries to snap to objects that you are moving towards. This makes it much more helpful and way less intrusive. You can still turn it off if you want to, but you won't want to!

Snapping now also works when rotating an object, with snapping at 0, 90, 180 and 270 degree.

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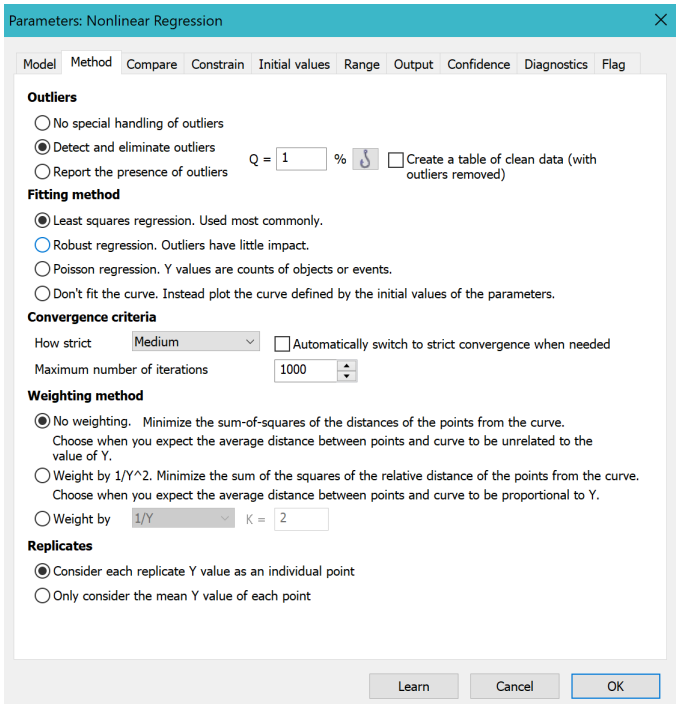
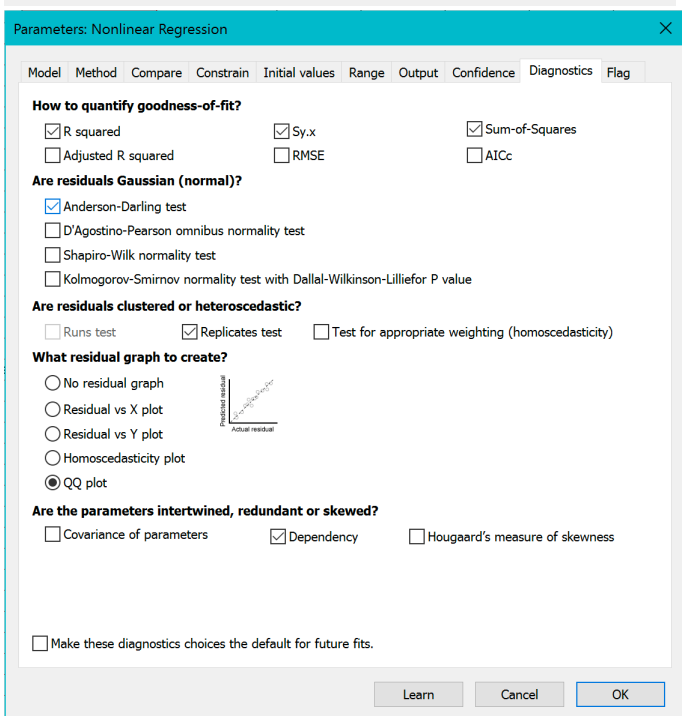
Simpler nonlinear regression dialog

We reorganized the nonlinear regression dialog to make it easier to use.





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- The first tab, now renamed to Model, is simpler as it no longer has choices about outliers or robust fitting.

- A new tab, Method, takes the place of the Weights tab which had only a few choices. The Method tab includes choices for weighting, and also includes these choices: Whether to perform least-squares, robust or Poisson regression, or to show the curve generated by the initial values; whether to count, exclude, or ignore outliers; and how to define convergence.

- The Diagnostics tab is less cluttered as some options were moved to the Method tab. Added to the Diagnostic tab is a choice of four kinds of residual graphs.

The complicated column statistics analysis has been split into three focused analyses

The column statistics analysis was complicated because it combined distinct analyses. Prism 8 makes things easier by offering three distinct analyses: Descriptive statistics, Normality (and lognormality) testing, and one-sample t test (and Wilcoxon) analyses.

Change size of graph more easily

The commands to enlarge a graph and reduce the graph size were not in synch in Prism 7. If you clicked twice to increase the graph size, then clicked twice to reduce graph size, you wouldn't end up where you started. The problem is that if you first increase size by 25% and then decrease by 25%, you don't end up where you started. You need to reduce by 20%. We fixed this for Prism 8.

Less intrusive warnings about graphs

Prism 7 often presented warnings on graph about data points that are off scale, error bars that can't be shown, etc. These tended to be wordy and were often annoying. Prism 8 shows much shorter messages, with a link to a longer explanation. And you can turn these off entirely with a new setting in Preferences.

Easier searching

Searching for sheets is easier, and you can now search for sheets with highlights or notes of a specified color.

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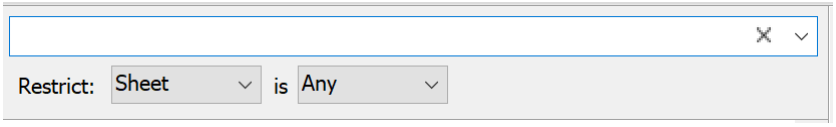


2.5 More efficient

Prism offers many methods to speed your work. Prism 8 goes even further.

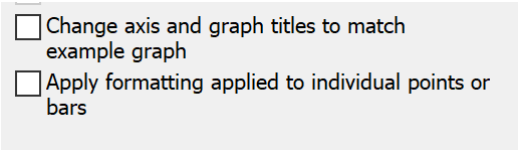
Repeat graphing and analyses easily

- The Wand (wizard to analyze data) lets you analyze and graph a new table exactly as you already analyzed an existing table. Now you can selected several tables at once and use the Wand to analyze and graph all of them at once.

- When using New..Graph of existing data to make one graph per data set, enter a Y axis title to appear on all the new graphs. You no longer need to enter the Y titles one at a time.

Better magic

Two new choices in "Magic" (Make Graphs Consistent):



- Change the axis and graph titles to match the sample graph. Magic always changed the font (and point size and color) to match. Now you can optionally (default is off) ask Prism to change the wording of the axis and graph titles.

- If you've individually changed the color (etc.) of some points/bars in the sample graph, you now have the choice to have the same changes made to the other graphs by "magic". This choice only makes sense, so is only available, when both the sample and target graphs have the same number of points/bars.

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Faster!

We've sped up many parts of the program.

- Many analyses are faster. Overall, we can run our set of thousands of test cases about twice as fast on Prism 8 than Prism 7.
- On average, nonlinear regression is 50% faster. But it depends on the data set and equation. Some fit 50 times faster. A few are a bit slower.
- Exact nonparametric tests are faster.
- Switching between sheets is much faster in some cases. So is displaying graphs and saving/opening pzfx files.

64-bit Windows version can do more

- Bigger data sets. Prism 8 64-bit can handle millions of values.
- importing larger Excel, TXT and XML files. "Disk or memory error occurred" alerts appear on importing large Excel and XML files (more than 20 000 000 values) in Prism 7 and "Not enough free space' alert appears in Prism 7 during importing large TXT file (more than 20 000 000 values) while Prism 8 64-bit can successfully import these files (slowly).
- Exporting large amount of data to TXT, CSV and XML file formats. "There is too much text to copy" and "There is not enough memory for normal operations" alerts appear in Prism 7 on exporting large amount of data to TXT, CSV and XML file formats (more than 10 000 000 values) while Prism 8 64-bit can successfully export these files file formats, though, it takes considerable time.
- Exporting large graphs or layouts to TIF format (Prism 7 exports graph to TIFF format when maximum width is up to 11 inches, while Prism 8 64-bit successfully exports graph to TIFF format when width if up to 25 inches).

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2.6 More compatible

Infrastructure (Windows only)

- Prism looks much better on a high resolution displays, even if you drag a Prism window from one display to the another with a different resolution or if you change display settings while Prism is running.

- Each open Prism Windows project now has its own window with its own toolbar and menu bar. This is the way all modern programs work. No more master Prism window containing the project windows.

- Prism Windows now comes in separate versions for 32- and 64-bit versions of Windows. The 64-bit version handles big data sets and big image imports better, and is more compatible with 64-bit versions of Office.

- Export (or copying) of graphs or layouts to EMF+ format is improved for greater compatibility with Office and other programs.

Unicode

Unicode. We did lots of work to the innards of Prism so all text is encoded in Unicode. This makes things much easier when handling mathematical characters, Greek letters, and text in Japanese, Mandarin, etc. Unicode is now the standard for handling text, and transferring text from one application to another, and Prism (Win and Mac) now supports it fully.

2.7 More versatile

Heat maps

- Rainbow heat maps now use red for the highest value and blue for the lowest. A new "Reverse rainbow" uses the opposite convention to match Prism 7.

- Specify axis and graph titles on heat maps.

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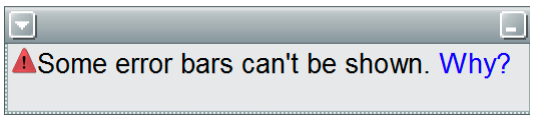
- On heat maps, when you choose to not label every row or column, but rather label every second (or third...) row or column. Prism now lets you choose which row or column to start from.

- You can make heat maps even with many thousand rows of data (Prism will average rows, when necessary).

More choices in preferences

- Turn off warning messages on graphs (about error bars, etc.). But those warnings are much shorter in Prism8, so you'll probably want to leave them on.

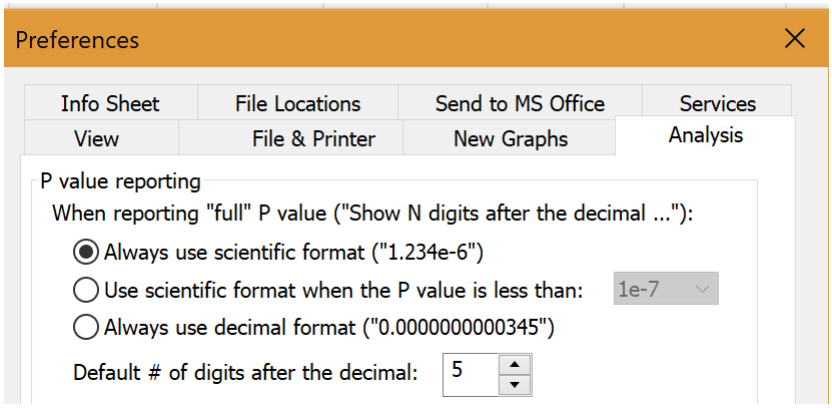


- Set the default tick length.

- Choose an ordinary minus sign or a longer en-dash to show negative numbers on axis numbering.

- Choose how long a column or row title should be before Prism switches to labeling with "Row 4" or "Column D".

- When to use scientific format to report P values -- always, never, or it depends.



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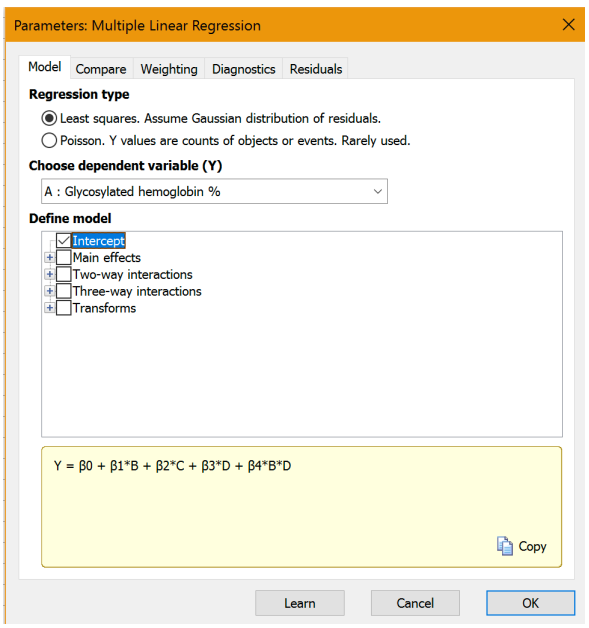
2.8 Multiple regression

New kind of table

Prism 8 offers a new kind of data table, multiple variables. It is arranged like most statistical programs. Each row represents a different subject or experiment or unit. Each column is for a different variable.

Multiple linear regression



The word "multiple" means that there are several independent (X) variables. **Multiple linear regression** fits an equation that predicts Y based on a linear combination of X variables. This is a standard analysis that you can read about in many books. Options:

- If the Y values are numbers of objects or events actually counted, Prism can do **Poisson regression**. If Y is a continuous variable, Prism does multiple linear regression.

- Include (or not) the intercept, two-way interactions between selected variables, and three-way interactions between selected variables.

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- Include transforms of the parameters in the model.
- Weight all the points equally or weight by $1/Y^2$ or some other weighting functions. Weighting is useful when variability is larger for points with larger Y values than for points with smaller Y values.
- Fit two alternative models and compare the goodness of fits.
- Graph actual vs. predicted (from the model) Y values.
- Graph the residuals in four ways.
- Test for normality of the residuals, and for multicollinearity of the parameters.

New analysis to extract and rearrange data

A new "Extract and rearrange" analysis lets you extract data from a portion of a multiple variable table and use it to create another kind of table. For example, you can move two columns in to a new XY table. Or put data from one column into a Column table using another column to define which data set each value goes into. Or cross-tabulate onto a chi-square table.

New analysis to select and transform and combine

Another analysis (Select and Transform) creates a new multiple variable table from an existing one. For example, you could select rows 1-100. Or if one of the columns is age, you could select only the rows of people older than 75. This analysis can also create new variables by transforming variables or by combining variables (for example take the ratio of two columns).

2.9 Huge improvements in ANOVA

Analyze repeated measures data with missing values.

Repeated measures ANOVA cannot be computed when even a single value is missing. This is a huge problem, and many people have asked us

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to do repeated measures ANOVA with missing values. This is not actually possible, but we did it anyway!

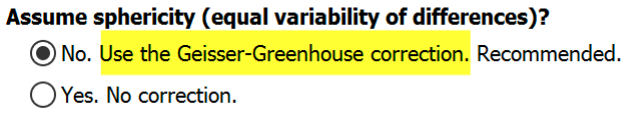
Prism 8 can now analyze repeated measures data (one-, two- and three-way) by **fitting a mixed effects model**. The analysis works differently than ANOVA but gives the same main results when there are no missing values and gives useful results when there are missing values. Of course, the results can be interpreted only if you assume that the values are missing for random reasons.

Other improvements in repeated measures ANOVA

- Analyze **three-way ANOVA with repeated measures** in any or all of the three factors. Prism 7 was much more restrictive.

- **Name the repeated measures factor.** Earlier versions always used the name "subject". Now you can choose "litter" or "animal" or "patient" or ....

- **Correct** for lack of sphericity with the **Geisser-Greenhouse correction.** Prism 7 could already do this with one-way ANOVA. Prism 8 can do it also with two- and three-way ANOVA.



More options in regular ANOVA

- **View a table of cell, row, column and grand means**

When values are missing (sample sizes are unequal), Prism shows the predicted LSmeans (least square means).

- **Test for homogeneity of variance** by calculating the nonparametric correlation between the predicted Y values and the absolute value of the residuals.

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Diagnostics for residuals

☐ Spearman's rank correlation test for heteroscedasticity.
Test if cells with larger values tend to have larger |residuals|.

☐ Are the residuals Gaussian?
Normality tests of Anderson-Darling, D'Agostino, Shapiro-Wilk and Kolmogorov-Smirnov.

- One-way ANOVA without assuming the data were sampled from populations with equal standard deviations. Prism will calculate the **Brown-Forsythe** and **Welch** ANOVA, followed by appropriate multiple comparisons tests: Games-Howell, Tamhane T2, DunnettT3 tests.

- With two-way data with only two columns and/or two rows, **view the difference between the two column (or row) means** along with its standard error and 95% confidence interval. If your table has two rows and two data sets, also view the interaction confidence interval.

Difference between column means	
Predicted (LS) mean of Wild-type cells	31.45
Predicted (LS) mean of GPP5 cell line	61.70
Difference between predicted means	-30.25
SE of difference	1.932
95% CI of difference	-34.37 to -26.13
Difference between row means	
Predicted (LS) mean of Serum starved	65.95
Predicted (LS) mean of Normal culture	27.20
Difference between predicted means	38.75
SE of difference	1.932
95% CI of difference	34.63 to 42.87
Interaction CI	
Mean diff, A1 - B1	-54.90
Mean diff, A2 - B2	-5.600
(A1 -B1) - (A2 - B2)	-49.30
95% CI of difference	-57.53 to -41.07
(B1 - A1) - (B2 - A2)	49.30
95% CI of difference	41.07 to 57.53

2.10 Nested t test and nested one-way ANOVA

Prism 8 offers a new kind of data table for **nested data** where values stacked in each subcolumn are related, and creates subcolumn **graphs** of these data. In this example, there are two treatments given to three rats each and the outcome variable was measured four times in each rat.

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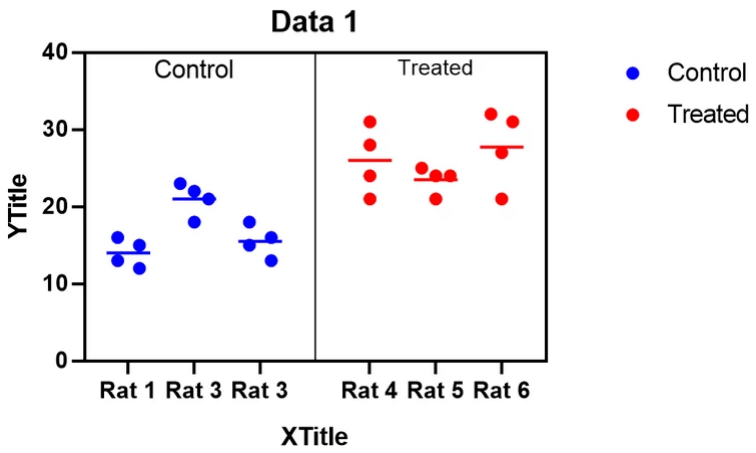

The different rats (different subcolumns) are actual replicates in the experiment, while the multiple measurements (different rows) are technical replicates. If you combined these and entered twelve replicates for each group into a t test, the results would be wrong. This is the error of *pseudoreplication*.

With two treatments (as in the example above), Prism 8 analyzes these data with what we are calling a *nested t test*. With three or more groups, Prism 8 offers the *nested one-way ANOVA*.

Note that "nested t test" and "nested one-way ANOVA" are not (yet!) standard terms. Prism actually runs the appropriate mixed-effects model, and this works even different subcolumns have different number of values, or different treatments have data in different number of subcolumns.

2.11 More analysis choices: Statistics

Test column data for normality and lognormality

- We've added one more normality test (**Anderson-Darling**). So now Prism can test for normality with four tests.

- The normality test of column data is now a separate analysis, rather than being an addon to column statistics.

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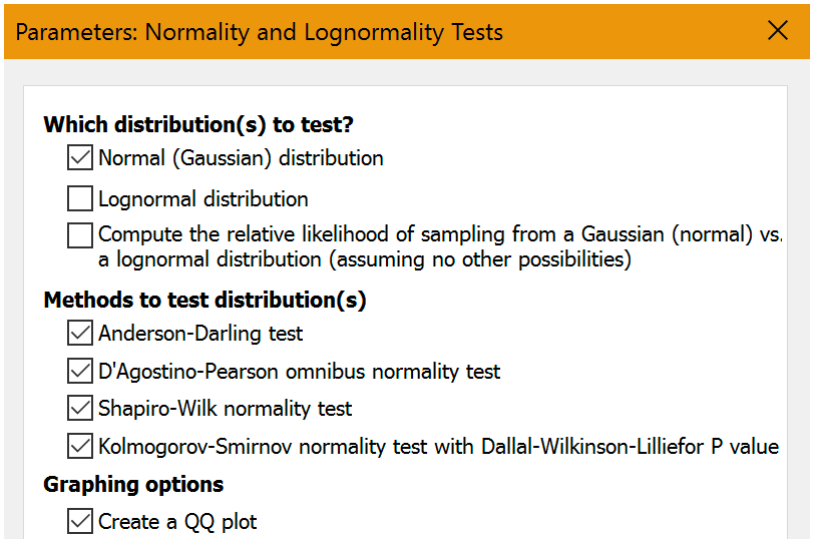
- In addition to (or instead of) testing for normality, test for **lognormality**, and test whether your data were more likely to have been sampled from a Normal (Gaussian) or lognormal distribution.

- Plot a **QQ plot** as part of normality testing.



New transforms

- Round data to a specified number of digits after the decimal point.

- Logarithm base 2, and its inverse (2^Y)

- Inverse statistical functions to compute a P value from a statistical ratio (and degrees of freedom) : zinv, tinv, chiinv, Finv (to be used when writing a user-defined equation or transform).

t tests

- The multiple t test analysis now automatically makes a volcano plot (difference vs. P value).

- The t test can now plot the confidence interval for the difference between means.

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- The one-sample t test can be used with data entered on a grouped table as mean, n and SD or SEM.

Other improvements

- Grubbs test reports the value of G when an outlier is found.
- With grouped, nested, or XY tables, individually test each subcolumn for outliers.
- The row statistics can compute mean and confidence interval.
- When creating a ROC curve, choose the confidence level you want (i.e. 99% instead of 95%) and the method used to compute it.
- The binomial test is much faster.
- Calculating asymmetrical confidence intervals for nonlinear regression is two-three times faster.
- Descriptive statistics include harmonic mean and quadratic mean with their confidence intervals.

2.12 More analysis choices: Regression

Plot residuals and test them for normality

A residual is the difference between the actual and predicted value of Y. Prism 7 let you plot one kind of residuals from regression.

Prism 8 expands this to tabulate residuals also from ANOVA (one-, two- or three-way), t tests and multiple regression. For each of these analyses, test for normality of residuals in four ways and plot the residuals in four ways (including a QQ plot).

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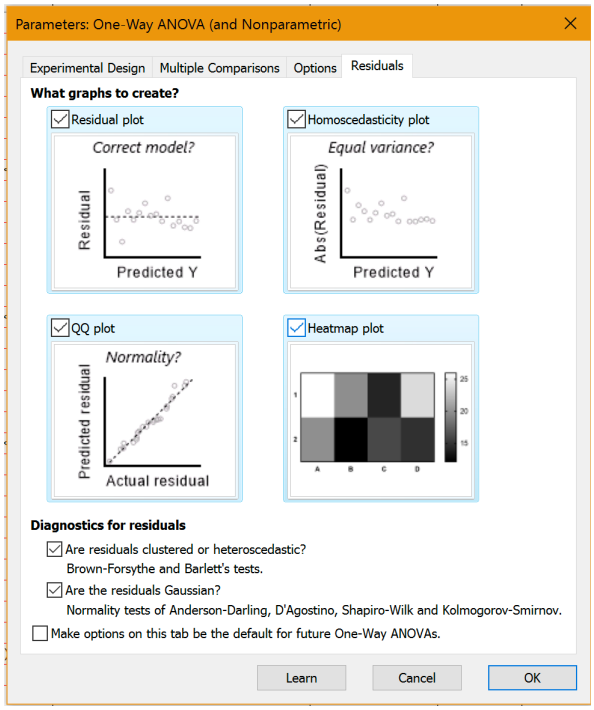

Poisson regression

When the Y values represent an actual number of counts of objects or events (not normalized in any way), the residuals are not expected to follow a Gaussian distribution, but rather to follow a Poisson distribution.

Prism now lets you specify that you expect Poisson residuals for both nonlinear and multiple regression, and the calculations are done accordingly.

More built-in equations for nonlinear regression

- **Pade(1,1) approximant equation**, useful for interpolating when the standard curve plateaus at large concentrations (it is similar to a rectangular hyperbola).

- Family of **growth equations**. These are used for everything from the growth of cell number in culture to the growth of economies. Equations offered are exponential growth, exponential plateau, Gompertz, logistic, and beta (growth then decay).

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- Several forms of the **linear quadratic equation** used to model cell death after exposure to radiation.
- **Hinge function**. It is the same as segmental linear regression, except that the two lines connect with a gentle curve instead of a hard angle.
- Fit straight lines to two data sets and find the **intersection point** and both slopes.

Asymmetrical (profile likelihood) confidence intervals

- Computing asymmetrical profile likelihood confidence intervals is 2-3 times faster.
- With difficult equations, Prism sometimes reported "???" rather than a value for one or both of the confidence limits. This can still happen, but much less often.

New choices

- When you choose to remove outliers in nonlinear regression, you can now ask Prism to create a results table with the "clean" data (without outliers).

3 What was new in earlier versions?

Version 7 of GraphPad Prism introduces many improvements in graphs 40, nonlinear regression 51, statistical analyses 55 and much more 63.

3.1 What was new in Prism 7?

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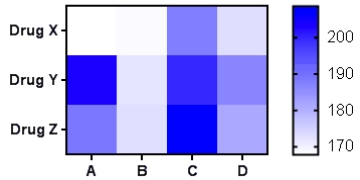
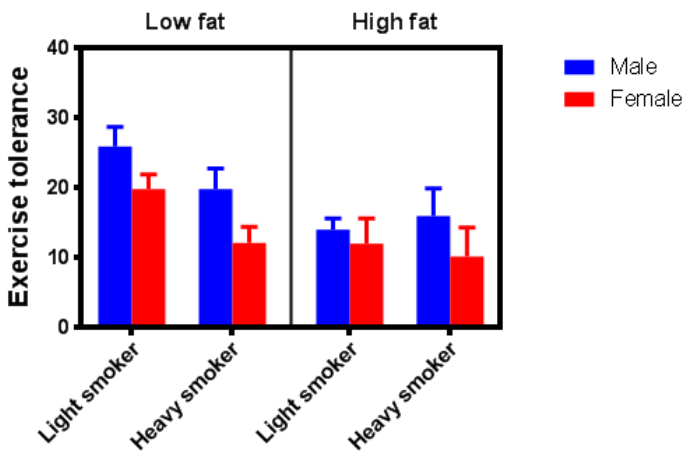
3.1.1 Highlights of what was new in Prism 7

Heat maps

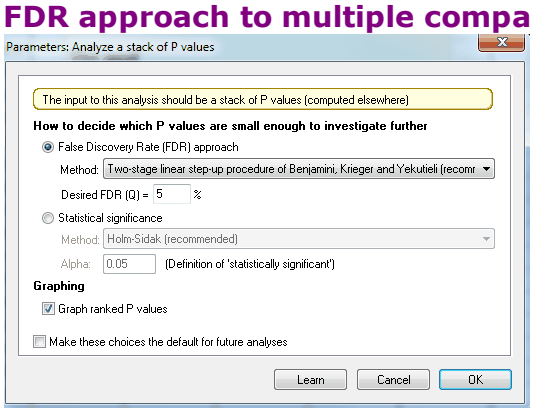


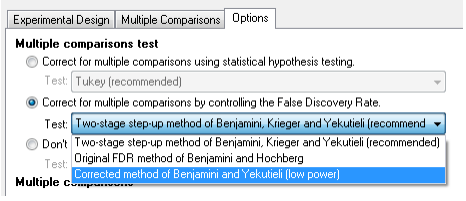
Three-way ANOVA

ANOVA table	SS	DF	MS	F (DFn, DFd)	P value
Gender	70.38	1	70.38	F (1, 1) = 7.539	P=0.0144
Treatment	242.6	1	242.6	F (1, 1) = 25.98	P=0.0001
Dose	176.6	1	176.6	F (1, 1) = 18.92	P=0.0005
Gender x Treatment	72.45	1	72.45	F (1, 1) = 7.761	P=0.0132
Gender x Dose	11.07	1	11.07	F (1, 1) = 1.186	P=0.2923
Treatment x Dose	13.65	1	13.65	F (1, 1) = 1.462	P=0.2441
Gender x Treatment x Dose	1.87	1	1.87	F (1, 1) = 0.2004	P=0.6604
Residual	149.4	16	9.335		

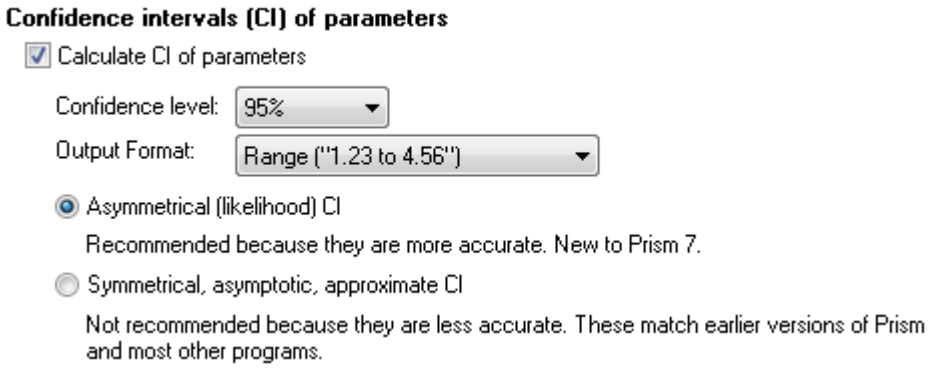


FDR approach to multiple comparisons

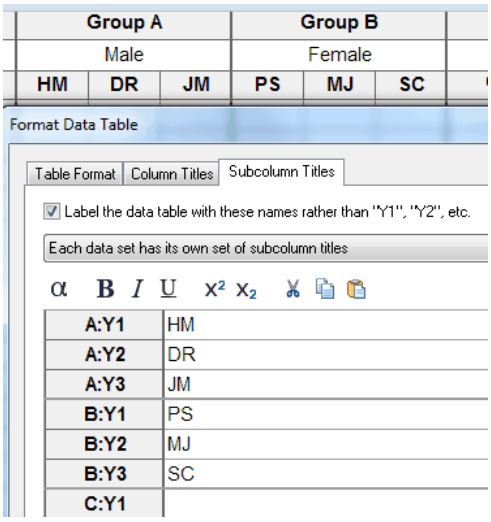




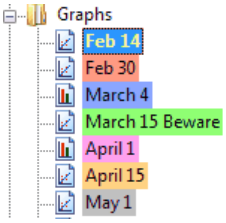
More accurate (asymmetrical, likelihood) confidence intervals from nonlinear regression



Label subcolumns



Color code sheet names, and selected cells in tables



A21	A34	A67	A21	A34	A67
170	175	165	161	173	157
186	194	201	164	166	159
180	187	199	162	184	183

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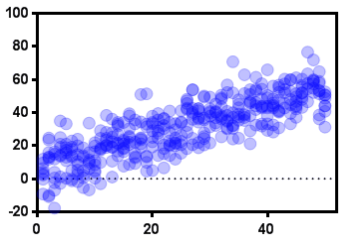
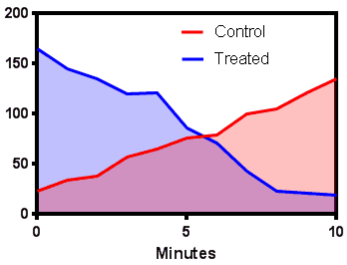
Semitransparent colors so you can see overlap





Enter dates (or elapsed times) as X values

Table format: XY		X	Group A
		Date	Weight (pounds)
		Date	Y
1	Title	13-Jul-2013	189
2	Title	6-Aug-2013	190
3	Title	21-Sep-2013	190
4	Title	11-Oct-2013	191
5	Title	23-Nov-2013	193
6	Title	26-Dec-2013	194

3.1.2 What was new: Graphs

Heat maps, semitransparent colors, dates and more.

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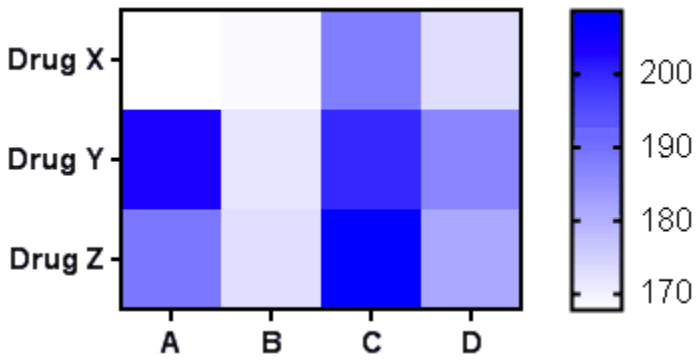
3.1.2.1 Heat maps



Heat maps are a new way to plot grouped data. The plotting area is divided into squares. The columns corresponds to different data sets in your table, and the rows in the graph correspond to different rows in the data table. Each square in the graph is color coded to denote the value entered into that cell of the table. Features:

- Reverse the direction of either axis, or transpose the X and Y axes.
- Color scales can encode continuous data with one scale, continuous data with two scales (perhaps one for positive numbers and another for negative numbers) or discrete categories (1=blue, 2=red, ...). Monochrome or color.
- Specify special colors for values that are "off the map" or for excluded values. Optionally put "X" through those cells.
- If you entered replicate values, base the heat map on the mean, median or geometric mean of the replicates. Or base it on the SD, SEM or CV among replicates to make a heat map of variation.
- Introduce more structure to the graph by inserting gaps to the right of any column or below any row.

3.1.2.2 Semitransparent colors to see overlapping points

When choosing any color, you can now specify that is be semitransparent 367 (or on a Mac, "semiopaque").

When symbols are semitransparent, this lets you see when several symbols are superimposed (they get darker).

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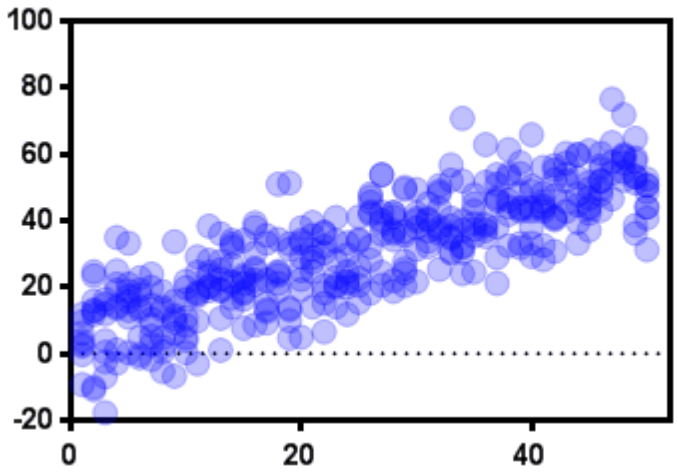
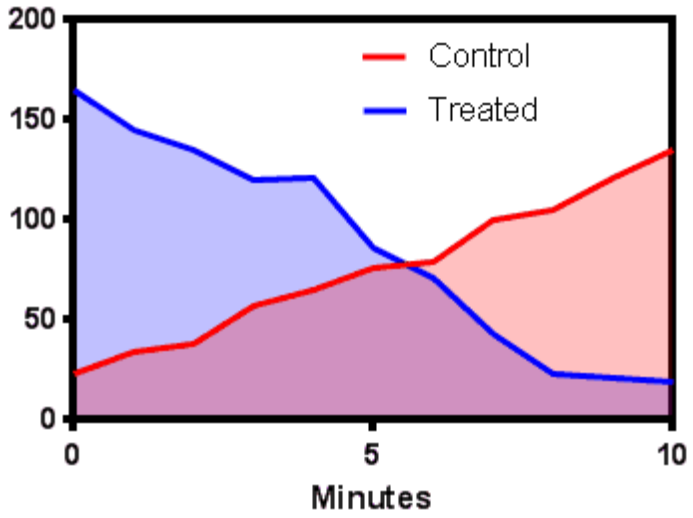


Semitransparent colors are also useful when shading under a curve.



3.1.2.3 Enter dates or elapsed time as X values

Prism lets you format the X column for entry of numbers , elapsed time in hh:mm:ss, or dates. Choose on the Welcome (File..New) dialog:

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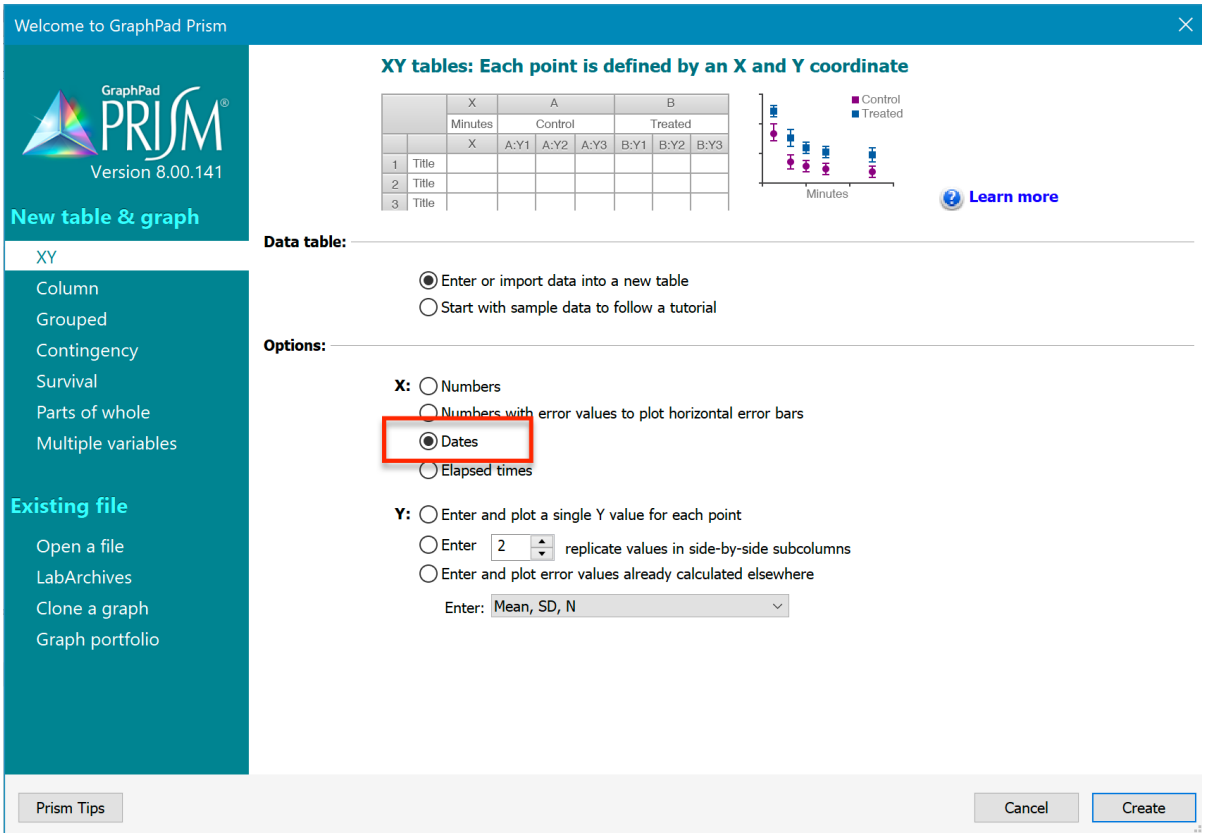

If you choose elapsed time, enter time as hh:mm or hh:mm:ss. For example, enter 1:12:30.2 to enter an elapsed time of 1 hour, 12 minutes, 30.2 seconds.

If you chose to enter dates, you can enter dates in almost any format. Prism will figure out what you meant and display the date on the table in a standard format (that you cannot change).

Table format: XY		X	Group A
		Date	Weight (pounds)
		Date	Y
1	Title	13-Jul-2013	189
2	Title	6-Aug-2013	190
3	Title	21-Sep-2013	190
4	Title	11-Oct-2013	191
5	Title	23-Nov-2013	193
6	Title	26-Dec-2013	194

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XY graphs can now label the X axis with the dates or elapsed times you entered.

When performing XY analyses (or making graphs with numerical X axis), the dates or elapsed times you entered are converted to numbers using units and a starting date that you choose in the Format Data Table dialog.

3.1.2.4 Three way grouped graphs

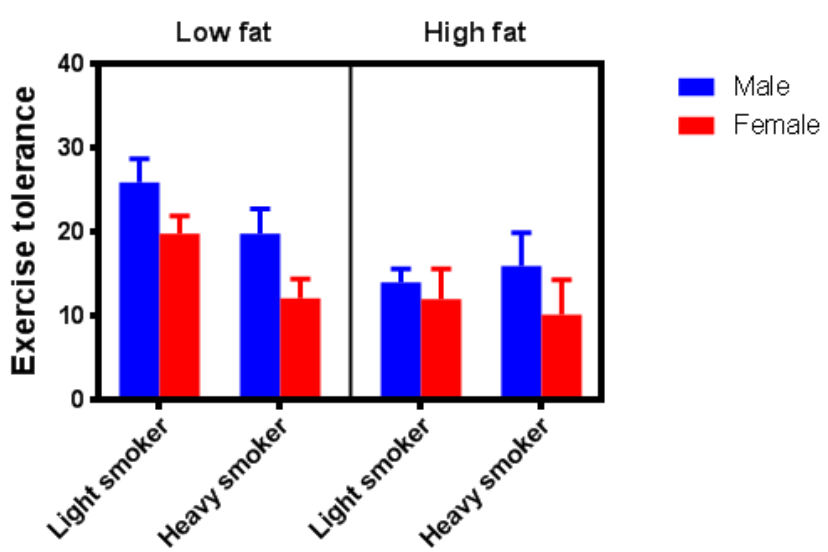
To go along with three-way ANOVA, Prism can also create three way grouped graphs.

Enter your data on a grouped table like this.

Table format: Grouped		Group A			Group B			Group C			Group D		
		Low fat Male			Low fat Female			High fat Male			High fat Female		
		A:Y1	A:Y2	A:Y3	B:Y1	B:Y2	B:Y3	C:Y1	C:Y2	C:Y3	D:Y1	D:Y2	D:Y3
1	Light smoker	24.1	29.2	24.6	20.0	21.9	17.6	14.6	15.3	12.3	16.1	9.3	10.8
2	Heavy smoker	17.6	18.8	23.2	14.8	10.3	11.3	14.9	20.4	12.8	10.1	14.4	6.1

Two of the factors must have only two levels (e.g. male/female; low fat/high fat), but the the third factor (designated by different rows) can have more levels (more than two rows).

Here is the three way graph, with labels produced automatically.



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3.1.2.5 Improvements with error bars

New error bar calculations

- When plotting medians, Prism offers a new choice of error bars: Median with 95% CI
- When plotting the geometric mean, Prism now offers to plot error bars showing the geometric SD. It also shows the geometric SD factor on the Column statistics results page.

New warnings

- If any error bar is smaller than the symbol, Prism now places a floating note on the graph explaining why the error bars are not shown.
- Prism will warn you if you mix SD and SEM error bars on the same graph, as this is usually not intentional.

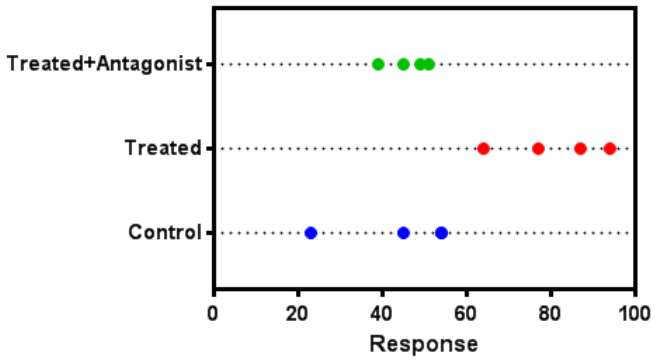
New default

- Prism 6 always defaulted to SD error bars. A new preference lets you choose whether you prefer to default to SD or SEM error bars.

3.1.2.6 Other improvements in graphing

New graphing options

- Add major grid lines on the categorical axis of Column and Grouped graphs.



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- Some box-and-whisker graphs plot individual points for large and small values. Prism 6 always plotted these points using solid circles. Prism 7 lets you choose any type of symbol.

- Prism lets you plot replicates on an XY graph as box-and-whiskers. Prism 6 always plotted these with the whiskers extending down to the minimum and up to the maximum value. Prism 7 now offers five choices for defining the whiskers (same choices that Prism 6 offered for Column box-and-whisker graphs).

- When plotting individual replicates on a XY plot, in addition to connecting the means, you can now draw lines that connect the median or geometric means.

- On grouped graphs, specify how large a gap you would like to see when a data table row is blank, and specify gaps before the first data set and after the last.

- On column graphs, specify how large a gap you would like to see before the first data set and after the last.

- When you make one graph per data set, Prism uses the column title of each data set as the graph title. Now this is a live link, so if you change the column title, the corresponding graph title will update.

- For bar graphs, the choice to use (or not use) a fill pattern is now more obvious in the Format Graph dialog. With prior versions you had to choose a solid fill pattern to get no fill pattern. Now just uncheck the option if you don't want a fill pattern.

Exporting

- Prism 7 Windows uses a superior library for exporting and importing bitmap (tiff, jpeg, png) images creates better image files compatible with more applications.

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- When exporting color graphs in tiff or jpg format, Prism Windows now lets you choose grayscale, where colors are converted to various shades of gray (Prism Mac already offered this choice).

Axes

- Use a comma as decimal separator in axis numbering.
- Discontinuities in the X or Y axis can now be shown with either perpendicular or angled gaps.

More versatility when drawing lines, boxes, etc.

- **Rotate** any line, rectangle, text object or imported image.
- When moving lines, arrows or objects, Prism shows more information in the tool tip (length, angle, position...).
- Set a default for the line width of lines and arrows you draw.

Legends

- Choose square (new) or rectangular legends for bar graphs.
- New command on the Change menu **reverses the order of a set of legends**.

Text

- You can now use **flush justification**.

Add information to graphs

New file constants let you add file name, and dates to graphs or layouts.

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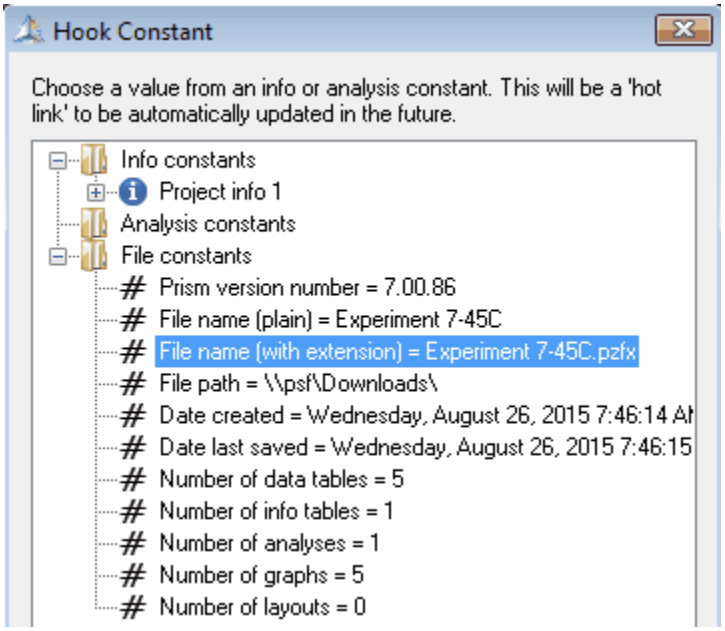

3.1.3 What was new: Nonlinear regression

More accurate asymmetrical confidence intervals,

test for homoscedasticity and more.

3.1.3.1 More accurate (asymmetrcial) confidence intervals from nonlinear regression

With all prior versions of Prism, the confidence intervals for parameters fit by nonlinear regression were always symmetrical around the best-fit value. These are called *asymptotic* intervals or approximate intervals. These are are what most nonlinear regression programs report. But the true uncertainty in a parameter's value, in many cases, is asymmetrical. In these cases, the symmetrical confidence intervals do not really express the precision of a parameter's estimate very well.

Prism 7 lets you choose to create asymmetrical confidence intervals instead. Based on the method used to compute these intervals, they are sometimes called *profile likelihood intervals*. These almost always do a

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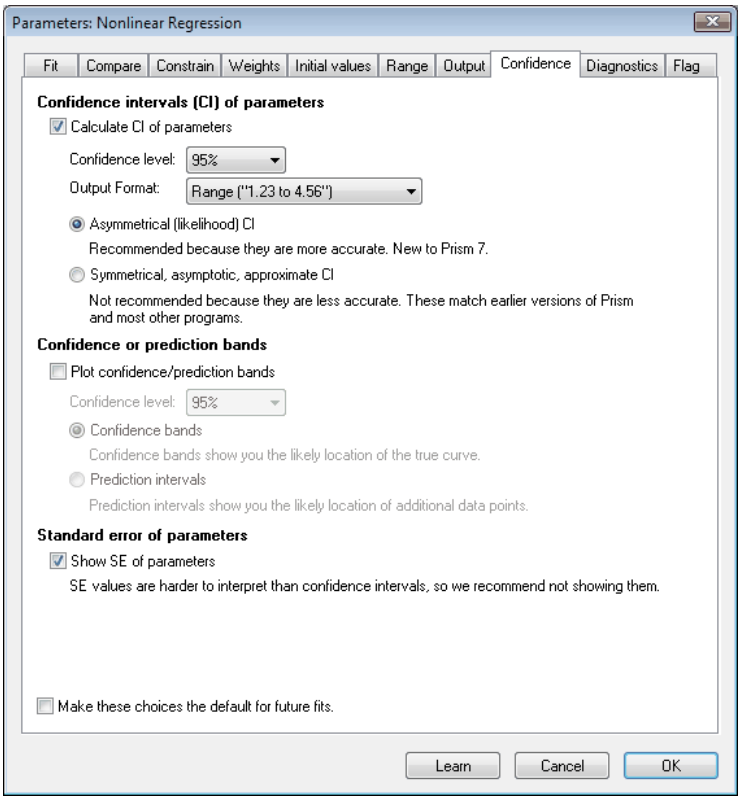
better job of expressing the precision of the parameter estimate, and in some cases a much better job.



The initial default is to show the asymmetrical intervals, but you can change this default (in the Confidence tab of the nonlinear regression dialog). Since the only purpose of the standard errors of the parameters is to compute the approximate confidence intervals, we suggest that you stop showing these once you get used to the new asymmetrical intervals.

The only disadvantage of this new way of computing the confidence interval is that the calculations are slower. But with modest data sets (few dozen data points), standard models, and reasonably fast computers, you won't notice. Prism 7 computes nonlinear regression more quickly than prior versions (about ten times faster if you choose a built-in equation), so you are unlikely to notice the slow down.

The availability of these new asymmetrical confidence intervals let us add new dose-response equations 54 where X is dose or concentration, rather than the logarithm of dose or concentration.

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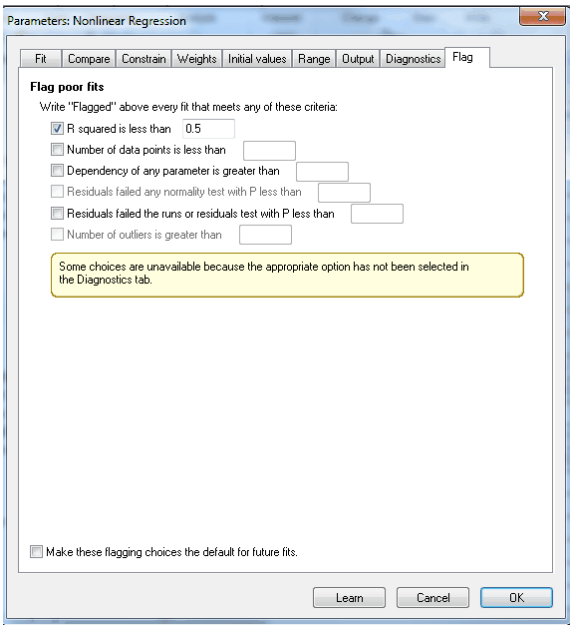
3.1.3.2 Test for homoscedasticity

Nonlinear regression assumes that the average distance of points from the curve is the same for all parts of the curve (homoscedasticity) or that you have chosen an appropriate option on the weights tab to correct for this problem.

Prism 7 can test for homoscedasticity or appropriate weighting. To do this, Prism 7 computes nonparametric correlation between the absolute values of the weighted residuals and the Y value of the curve. A low P value from this test means that the weighted residual is correlated with the Y value of the curve, and this suggests the weighting choice was not ideal.

3.1.3.3 Flag bad fits

Some scientists run many fits, perhaps using a script, or review many fits run by others. Prism 7 provides a way to flag poor fits, so you you know which data sets and results to inspect more carefully.



- Define "poor" fits on the new Flags tab on the parameters dialog of nonlinear regression. Flag a fit because the R^2 is too low (you define how low that is), when the number of outliers is too high (you define how high that is), when a dependency is too high, or when the residuals fail a normality test, or the runs or residual test.

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- When running Monte Carlo simulations choose to skip any results from fits that were flagged as being poor.

- When comparing two models, you can tell Prism to skip formal comparisons when one fit is flagged as being poor, and always choose the other fit in that case.

3.1.3.4 More choices for user-defined equations

- When editing an equation, the innermost parentheses around the insertion point are always highlighted to help you avoid mistakes that can occur when you are lost in a sea of parentheses.

```
Y=Bottom + (Top-Bottom)/(1+10^((LogIC50-X)*HillSlope))
```

- New choices for rules rules for initial values. You can now compute the initial value as a constant value multiplied or divided by the initial slope, the final slope, or the slope at the middle of the graph.

- When defining an equation, you can enter equations to report values calculated from the parameters. Enter "Y[logEC50]" to report the Y value when X=logEC50, or "X[B]" to report the X value when Y=B.

- Three improvements when fitting a model defined by a differential equation:

  - Set X0 to any value (Prism 6 always set it to 0.0).

  - Use the <A> or <B> notation to define different equations for different data sets.

  - Choose to share or not share the value of Y0 among data sets.

3.1.3.5 Improved built-in equatons

- A new set of dose response equations fit data where X is dose or concentration, to complement the existing set of equations where X is the logarithm of dose or concentration.

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- Faster. When you choose a built-in equation, nonlinear regression is more than ten times faster than it was with Prism 6, with improved precision. This is because the derivatives (and second derivatives) are now evaluated analytically rather than numerically. This will even work when you clone a built-in equation and change parameter names. This extra speed is noticeable when you have lots of data, do Monte Carlo simulations, ask for Hougaard's measure of asymmetry, or ask for asymmetric likelihood confidence intervals (which require more computation).

- The rules for initial values have been improved for the parameter Width in the log(Gaussian) distribution, for all three parameters in the equation for enzyme substrate inhibition, and for the Amplitude of a sine wave.

- New equation for sine wave with nonzero baseline.

- Renamed "One-site --- specific binding with Hill slope" equation to "Specific binding with Hill slope", because with a Hill Slope that doesn't equal 1.0, this equation really necessarily describe binding to one site.

3.1.4 What was new: Statistical analyses

Three way ANOVA, analyze a stack of P values,

control the FDR and more.

3.1.4.1 Three way ANOVA

Prism has been able to perform one- and two-way ANOVA for many versions, and now can also perform three-way ANOVA.

Enter your data on a grouped table like this.

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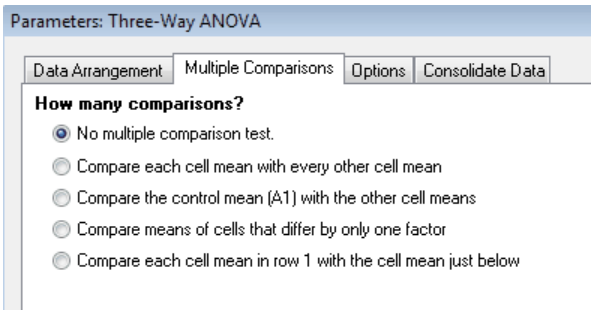
Table format: Grouped		Group A			Group B			Group C			Group D		
		Low fat Male			Low fat Female			High fat Male			High fat Female		
		A:Y1	A:Y2	A:Y3	B:Y1	B:Y2	B:Y3	C:Y1	C:Y2	C:Y3	D:Y1	D:Y2	D:Y3
1	Light smoker	24.1	29.2	24.6	20.0	21.9	17.6	14.6	15.3	12.3	16.1	9.3	10.8
2	Heavy smoker	17.6	18.8	23.2	14.8	10.3	11.3	14.9	20.4	12.8	10.1	14.4	6.1

Two of the factors must have only two levels (e.g. male/female; low fat/high fat), but the the third factor (designated by different rows) can have more levels (more than two rows).

The three-way ANOVA dialog is similar to the dialog for one- and two-way ANOVA, but the choices for multiple comparison goal are a bit different:



Here is a portion of the results table, showing all seven P values. Yes, seven! Three-way ANOVA is complicated.

ANOVA table	SS	DF	MS	F (DFn, DFd)	P value
Gender	70.38	1	70.38	F (1, 1) = 7.539	P=0.0144
Treatment	242.6	1	242.6	F (1, 1) = 25.98	P=0.0001
Dose	176.6	1	176.6	F (1, 1) = 18.92	P=0.0005
Gender x Treatment	72.45	1	72.45	F (1, 1) = 7.761	P=0.0132
Gender x Dose	11.07	1	11.07	F (1, 1) = 1.186	P=0.2923
Treatment x Dose	13.65	1	13.65	F (1, 1) = 1.462	P=0.2441
Gender x Treatment x Dose	1.87	1	1.87	F (1, 1) = 0.2004	P=0.6604
Residual	149.4	16	9.335		

Prism 7 provides a new kind of three-way graph to display data entered into three-way ANOVA:

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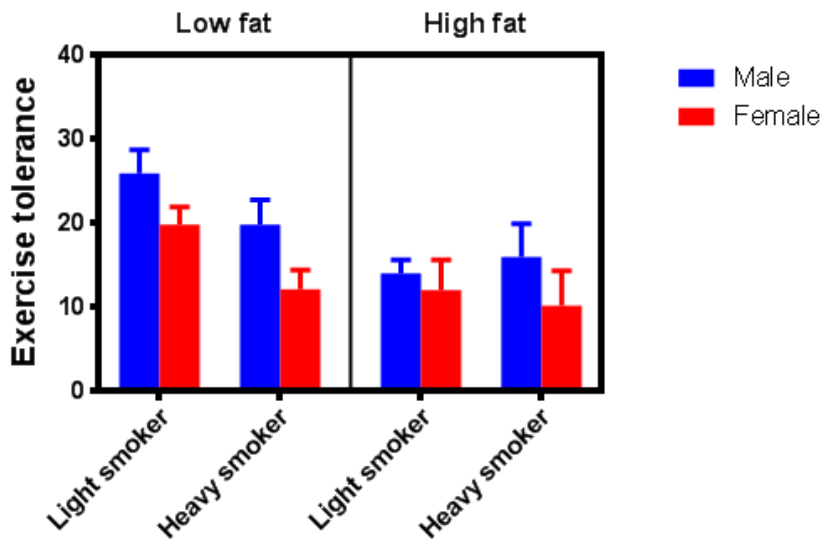
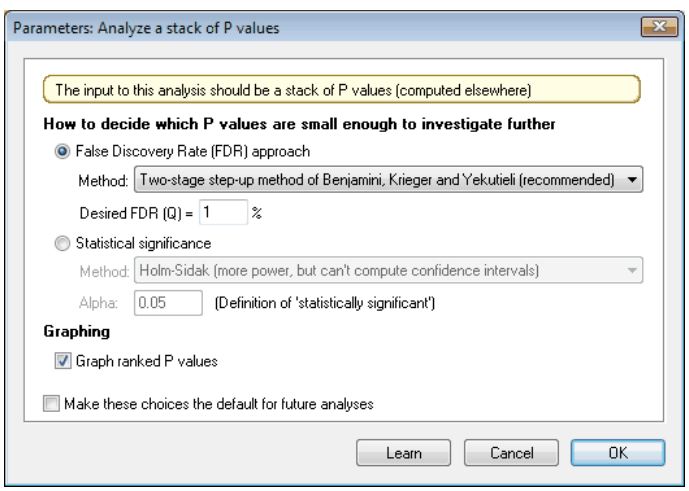


3.1.4.2 Analyze a stack of P values

Enter a stack of P values that were computed elsewhere into a column A of a Prism Column table, and choose this new analysis to determine which of those P values are small enough for the corresponding comparison to be worth investigating further. Use the approach of statistical significance with multiple comparisons or the method of controlling the false-discovery rate.



This analysis also lets you plot the rank of each P value vs. the actual P value, a common way to visualize the distribution of a set of P values.

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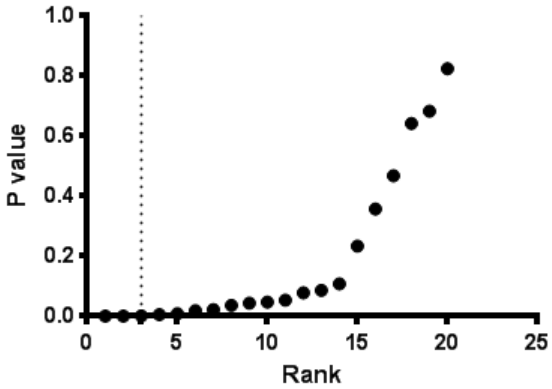

3.1.4.3 Control the false discovery rate (FDR)

Correct for multiple comparisons by controlling the False Discovery Rate

Controlling the False Discovery Rate (FDR) is a great method for coping with multiple comparisons. Prism 6 offered this as part of the multiple t test analysis. Prism now offers it in three places.

As a followup to ANOVA

Prism has long offered multiple comparisons tests after ANOVA to control the Type I error rate for the family of comparisons. Now Prism 7 lets you use an alternative strategy for multiple comparisons following ANOVA (one-, two- or three-way): controlling the False Discovery Rate (FDR).

Multiple comparisons for P values computed elsewhere

Prism offers an analysis to analyze a stack of P values computed elsewhere. You enter a set of P values into a column and choose this analysis. Prism graphs the rank of each P value vs. the P value itself. This is a standard way to visualize the distribution of a set of P values.

Which P values are small enough so the corresponding finding should be flagged as "statistically significant"? Choose to control the False Discovery Rate or the familywise Type I error rate using the method of Bonferroni, Sidak or Holm.

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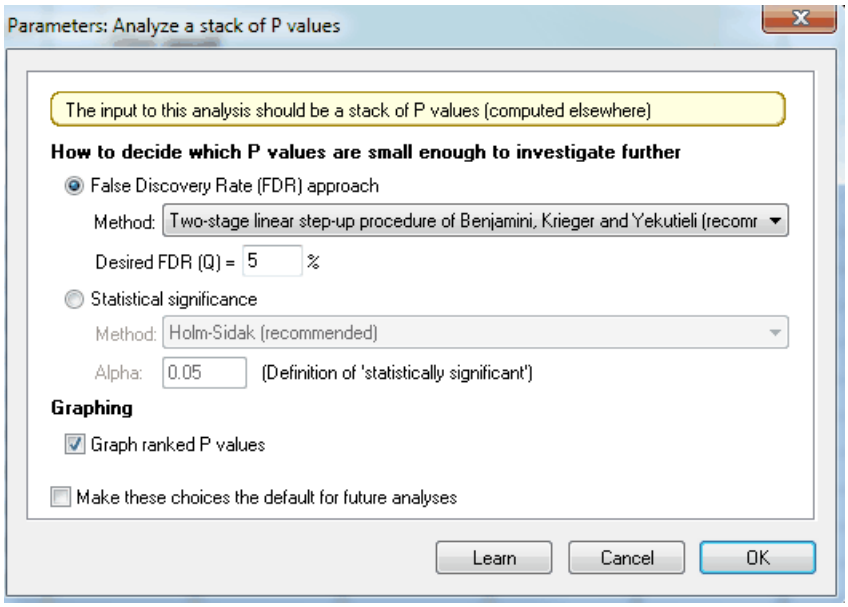
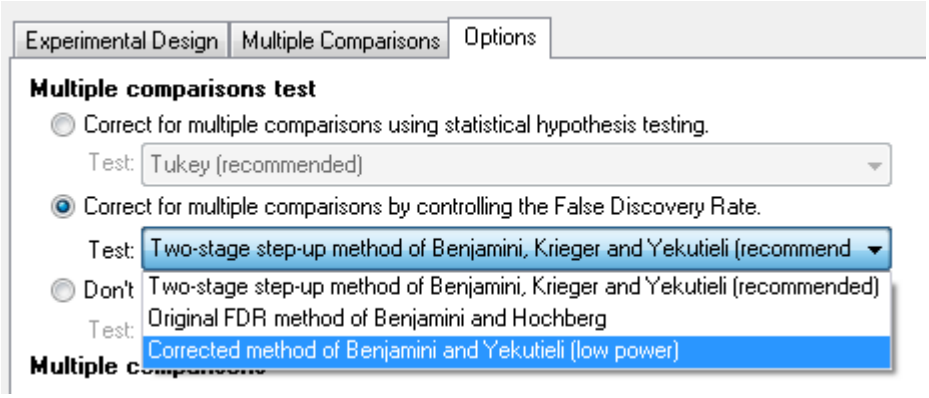


Multiple t tests, one per row

Prism 6 introduced an analysis to run multiple t tests, one per row. If you choose the method that controls the Prism 7 also reported q values (also called adjusted P values) for each comparison.

Three algorithms for using the FDR method

Whenever you choose to use the FDR approach to decide which P values are small enough to be a "discovery", Prism lets you choose one of three methods for controlling the FDR.



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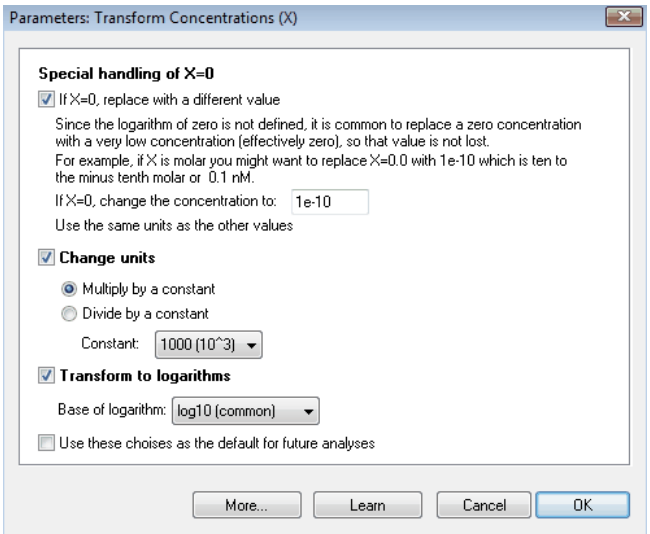
3.1.4.4 New analysis to transform concentrations

This analysis can do any or all of these tree things:

- Handle zero concentrations differently. Zero concentrations are sometimes a problem because the logarithm of zero is not defined, so zero concentrations are lost in a log transform. With this analysis, you can specify that zero be substituted with a low value (say 10-9) before taking the logarithm.

- Change units, for example from molar to nanomolar. Simply tell Prism what constant to multiply or divide by.

- Transform to logarithms, often needed prior to fitting a curve.



3.1.4.5 Choose how to report P values

Most of Prism's analyses report P values, and now all these analyses let you choose how to report P values.

Prism gives you four choices:

- The APA (American Psychological Association) style, which shows three digits but omits the leading zero (.123). P values less than 0.001 shown as "< .001". All P values less than 0.001 are summarized with three asterisks, with no possibility of four asterisks.

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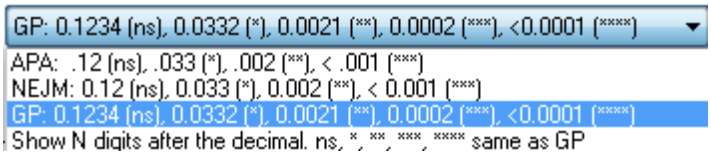
- The NEJM (New England Journal of Medicine) style, which shows three digits and includes the leading zero (0.123). P values less than 0.001 shown as "< .001". All P values less than 0.001 are summarized with three asterisks, with no possibility of four asterisks.

- The now classic GraphPad method which reports four digits after the decimal point with a leading zero (0.1234). P values less than 0.0001 shown as "< .0001". P values less than 0.001 are summarized with three asterisks, and P values less than 0.0001 are summarized with four asterisks.

- Choose how many digits you want to see after the decimal point, up to 15. P values less than 0.001 are given three asterisks, and P values less than 0.0001 are given four asterisks.



3.1.4.6 Improved analyses of 2x2 contingency tables

More complete analyses

Prism now reports the reciprocal of the relative risk and odds ratio, and their confidence interval. Depending on the meaning of the rows and columns, the reciprocal may be more meaningful to you.

When you choose to report the difference between proportions, its reciprocal called the *Number Needed to Treat* (NNT) is also computed along with its confidence interval.

Choice of algorithms

Prism offers new algorithms when computing the confidence interval of a proportion, the difference between two proportions, the relative risk, or the odds ratios.

The methods used by prior versions were simple approximations, and the improved methods Prism now offers produce narrower intervals that still provide the desired confidence level. We suggest you use them routinely.

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3.1.4.7 Other improvements in statistical analyses

- The Row Statistics analysis can now report means only without SD or SEM.
- One-way ANOVA now works even if any of the data set columns has only a single value.
- Two-way ANOVA can now do multiple comparisons comparing every cell with every other cell if the data are repeated measures in both factors.
- The Normalize analysis can now normalize each subcolumn separately, using its own definition of 100% and 0%.
- The correlation matrix analysis now reports a third page of results showing number of XY pairs for each pair of variables (missing values can lead to different n for different variable pairs).
- Enter starting and ending dates for each subject in a survival analysis instead of entering number of days (or weeks..).
- If you enter data with replicates (or enter mean, n and SD or SEM), the Area under the curve (AUC) analysis will now report the AUC with a standard error and 95% confidence interval.
- The multiple t test analysis now reports multiplicity adjusted P values.
- The Shapiro-Wilk normality test now works with a sample as small as n=3.
- The Remove Baseline & Column Math analysis now gives you choices for reporting the column titles. If the column titles in your data table are "Control" and "Treated" and you ask the analysis to subtract one from the other, you can have the second results column labeled as "B-A" or "Treated-Control" or just "Treated".

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3.1.5 What was new: General

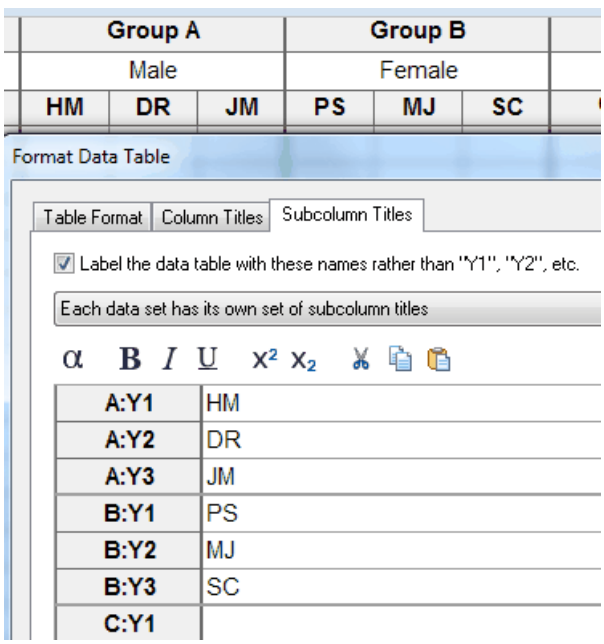
Color code sheet names or cells, label subcolumns,

and more.

3.1.5.1 Label subcolumns

By default subcolumns are labeled Y1, Y2, Y3, etc. You can enter your own subcolumn titles. Double click on a subcolumn title to bring up the appropriate dialog.

Apply one set of subcolumn titles 244 to all data sets, or label each subcolumn in each data set uniquely.



3.1.5.2 Color code selected cells in tables

Highlight selected cells 253 of data or results tables with a choice of colors.

Use one color to mark values that you want to double check, and color for cells you want to discuss with a colleague, another for key results you want to find again. Or color code different parts of an experiment.

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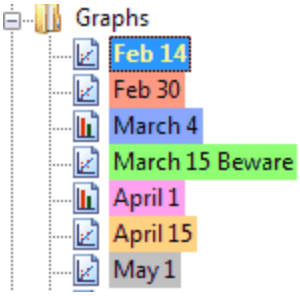
A21	A34	A67	A21	A34	A67
170	175	165	161	173	157
186	194	201	164	166	159
180	187	199	162	184	183

3.1.5.3 Color code sheet names

Choose from nine color when highlighting a sheet name 189.

You might want to choose one color to highlight the most important results, another color to mark sheets you need to discuss with a colleague or mentor, and yet another color to mark the graphs that were included in a paper.



3.1.5.4 New Family menu

Working with families of linked sheets is an important method for working efficiently in Prism, but the commands that worked with families of sheets have been scattered around the program, and many people never discovered them.

A new Family menu 150 in Prism 7 consolidates all these commands, making it easier to view, delete, duplicate, highlight, save or print all related sheets in a family. It also offers a new command to highlight all sheet names in the family.

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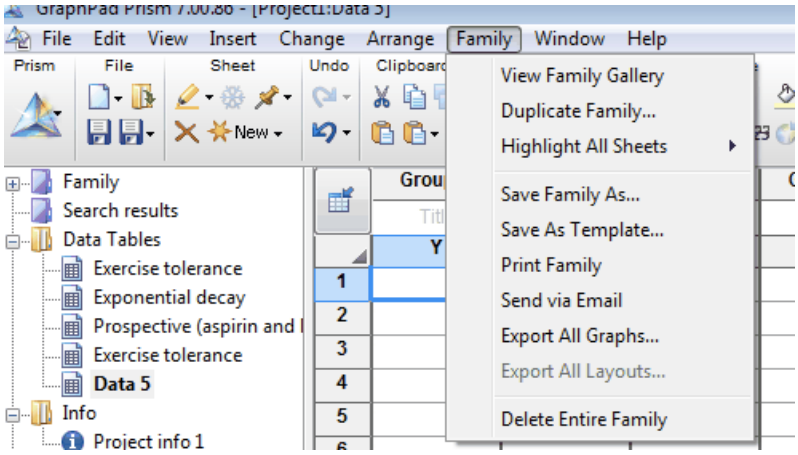
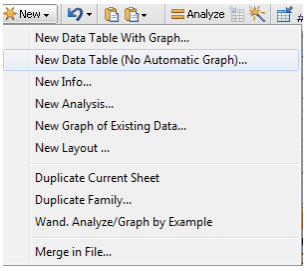


3.1.5.5 New shortcuts to work more efficiently

We know that some people use Prism almost every day, so we work hard to provide time savers for frequent users. Improvements in Prism 7:

- Create a new data table without a linked graph.



- When creating a layout 545, assign a series of graphs so you don't have to add them one at a time.

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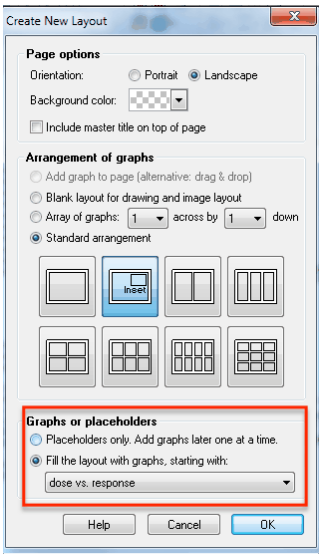

- Set a preference to make bar graphs without bar borders.
- Reverse the order of legends instantly.
- With parts-of-whole graphs you can now choose which data set to graph (these graphs can only plot one data set). Prism 6 only plotted data set A.
- The script editor shows line numbers, making it easier to edit long scripts.
- New script command to save all graphs or all layouts in a single pdf file.
- The Wand 175 graphs data on a new table just like you have already graphed another table (even if that table was not analyzed).
- When editing an equation, the innermost parentheses around the insertion point are always highlighted to help you avoid mistakes that occur when you are lost in a sea of parentheses.

```
Y=Bottom + (Top-Bottom)/(1+10^((LogIC50-X)*HillSlope))
```

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3.1.5.6 Uses OS X Versions and Resume (Mac only)

Prism 7 uses the Versions and Resume features of OS X to make it easier to get your work done without thinking about saving files. Your work is saved as you go, with no need to ever click the Save button (although you can). Automatic backup is handled by the Mac Versions and Resume feature, and is no longer handled by code we wrote.

This is a change Apple introduced a few years ago. If you use iWork (Pages, Numbers, Keynote), you already know about Versions and Resume. If you don't use iWork, spend a minute reading about these features 135 to avoid frustration.

3.1.5.7 Enter data with more digits

Prism 7 lets you enter data with 13-14 digits for each value (double precision). In contrast, Prism 6 allowed to to enter only 6-7 digits (single precision).

Allowing more digits prevents round off errors when importing or pasting data with more than 6 or 7 digits of precision.

Additionally, all calculations now use doubles instead of integers. This allows Prism to avoid integer overflow and as a results work better with large data sets (large N). Prism already use double-precision floating point math.

3.1.5.8 Looks better on high resolution displays

Many people now use computer displays with high resolution. Apple calls these retina displays.

Prism 7 Windows works much better on high resolution displays.

Prism 6 Mac already worked well on retina displays, but Prism 7 looks even better with high resolution icons.

3.1.5.9 Work with larger files

We improved how Prism manages computer memory, so it can now work with larger files than before.

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3.2 What was new in Prism 6?

When creating Prism 6, our goals were ambitious:

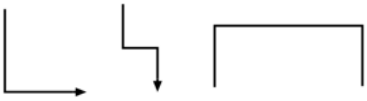
- To simplify Prism so it is easier to learn and even more efficient to use.
- To greatly improve its statistical clout and graphical versatility.
- To make Prism 6 appeal to a wider group of scientists and students.
- To make the transition from Prism 5 (or earlier) to Prism 6 be graceful, and for people who make the switch to rapidly discover that Prism 6 simply works better.

Links to the full lists of new features:

Highlights 68
Statistics 71
Multiple comparisons 74
Regression 76
Data tables 81
Working with other programs 82
Parts-of-whole data 84
Column graphs 85
XY Graphs 87
Grouped graphs 89
Layouts 90
Time savers 78

3.2.1 What's new? Highlights

Prism 6 is a big upgrade with many improvements. It has more statistical clout, can make more kinds of graphs, and is even more efficient to use. But Prism is still Prism. The basic interface and organization of the program has not changed, so you can switch to Prism 6 with almost no learning curve. And you can try



Zig-zag and elbow lines

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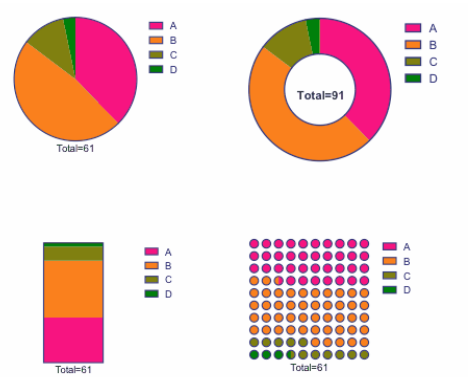
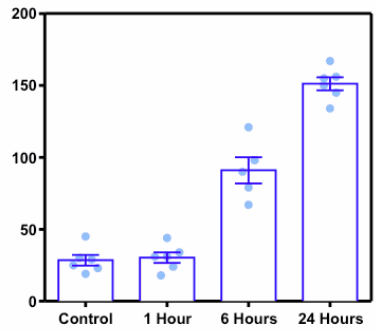
the Prism 6 demo without removing Prism 5.



Pie charts and more

Statistics

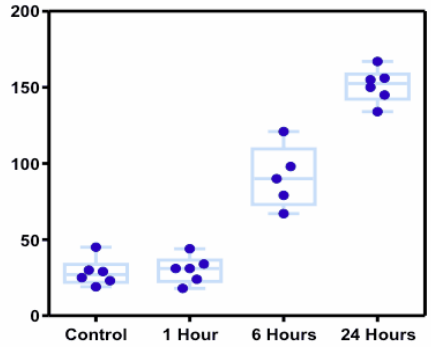
- Two-way ANOVA with repeated measures in both factors
- Detect outliers in a column of data using Grubbs' test
- Calculate and graph 95% CI of median with Wilcoxon test
- Calculate and graph 95% CI of difference between medians with Mann-Whitney test
- Greenhouse-Geisser correction in one-way repeated measures ANOVA
- Ratio t test
- Kolmogorov-Smirnov test (alternative to Mann-Whitney)
- Multiple tests (one-per row) with optional correction for multiple comparisons
- Monte-Carlo analyses



Superimpose individual data points with bars

Multiple comparisons

- Exact (multiplicity adjusted) P values with Bonferroni, Tukey and Dunnett's tests.
- Graph 95% CI of difference between means
- New approach: Fisher’s unprotected Least Significant Difference (LSD)
- New multiple comparisons test: Holm-Sidak
- Test main or simple effects after two-way ANOVA
- Dunnett's test now can handle up to 256 groups (up from 20)



Superimpose individual data points with box-whiskers

Nonlinear regression

- Fit to models defined by implicit and differential equations.
- Write more complex models

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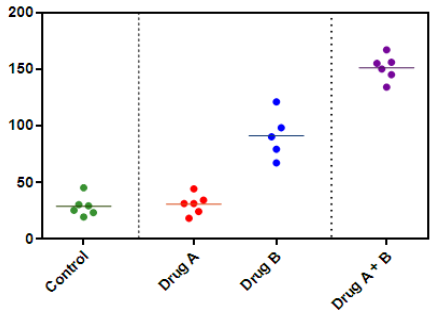
- Weight your fit by $1/Y^K$
- Much easier interpolation

Bigger data tables

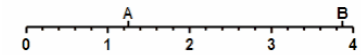
- Enter data in up to 256 data set columns (up from 52 in Prism 5)
- Create data sets with up to 256 subcolumns (up from 52) to allow repeated measures 2 way ANOVA with more subjects



Separate columns with lines

Row and column titles

- Write two or three line titles
- Use bold and italics
- Make titles as long as necessary
- View and edit all of your column titles at once



Label both sides of an axis

Work more efficiently

- Faster in many ways: saving, graphing, exporting and closing
- Nonparametric calculations are way way faster!
- Format several data sets at once. Want to plot alternating columns as dotted lines? Now you can do it in one step.
- Paste link data or results copied from Prism, and those values will be hot linked
- Choose the size, shape and color of selected data points right from the data table
- More choices when exporting
- Set defaults as you work. Many dialogs now a have checkbox to make your choices on that dialog (or tab) become the defaults when you use that dialog in the future.
- Much easier to create the graph you want since you don't pick the graph type until after entering data. Preview how different

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graphs look with your data before deciding.
- Search a large project to find pages that include specified text

3.2.2 What's new? Statistics

Repeated measures ANOVA

- Two-way ANOVA with repeated measures in both factors. Prism 5 could only compute two-way ANOVA with repeated measures in one of the factors. Prism 6 can handle repeated measures in both factors.

- More subjects 236. Prism 6 now allows up to 256 subcolumns, so can perform repeated measures two-way ANVOA with up to 256 subjects per treatment.

- The Greenhouse-Geisser correction allows repeated measures one-way ANOVA to work, even when the assumption of sphericity is violated because the repeated measurements are made in too short a time interval, so that random factors that cause a particular value to be high (or low) don't wash away or dissipate before the next measurement. In this case, multiple comparisons are also computed so as to not assume sphericity.

Survival analylsis

- Prism now computes the hazard ratio (HR) by two methods: The logrank method and the Mantel-Haenszel method.

- If people in group A die at twice the rate of people in group B (HR=2.0), then people in group B die at half the rate of people in group A (HR=0.5). Prism now reports the hazard ratio, and its confidence interval, both ways so you can report the one that makes most sense in your clinical context.

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- If people in group A have a median survival time three times people in group B, then people in group B have one third the median survival of people in group A. Prism now reports the ratio of median survival times, and its confidence interval, both ways so you can choose which to report.

Analyses of column data (t tests etc.)

- Mann-Whitney tests reports 95% CI of difference between medians. The Mann-Whitney test is often described as comparing the median of the two groups. That is not precisely correct, as it is possible for two groups to have the same median, but for the Mann-Whitney test to find that the difference between the distribution of ranks among the two groups is statistically significant. However, if you assume that the two distributions have roughly the same shape, then it is fair to think of the Mann-Whitney test as comparing two medians. Accordingly, Prism 6 can now report the confidence interval for the difference of two medians.

- The Wilcoxon test computes the 95% CI of the median. The Wilcoxon matched-pairs test (nonparametric test of two paired or matched groups) reports the confidence interval of the median of the paired differences, and the Wilcoxon signed rank sum test (nonparametric test to compare a median with a hypothetical median) now reports the confidence interval of the difference between the actual sample median and the hypothetical median.

- Ratio t test. The paired t test works by analyzing the difference between each pair of values, testing the null hypothesis that the average difference is zero. With some kinds of data, the difference between before and after is not a consistent measure of effect. The differences might be larger when the "before" values are larger, and smaller when the "before" values are smaller. The ratio (after/before) may be a much more consistent way to quantify the effect of the treatment. Actually, it turns out that analyzing the logarithm of ratios works much better.

- Kolmogorov-Smirnov test. Like the Mann-Whitney (MW) test, the Kolmogorov-Smirnov (KS) test, is a nonparametric method to compare two groups. The KS test works by comparing the two cumulative frequency distributions, and so has more power to detect subtle differences in the two distributions. In contrast, the MW test is better at detecting changes in the median. The use of the KS test has become

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standard in some scientific fields. Don't confuse this test with the the other version of the KS test used for normality testing.

- Faster nonparametric tests. To avoid slow calculations, Prism reports an approximate P value for nonparametric tests with large data sets. Prism 5 also reported approximate P values when several values were identical and so tied for the same rank. Prism 6 performs the exact calculations much faster (hundreds of times faster!), and so does exact calculations even for fairly large data sets and even when several values are identical and so tie for the same rank.

- Identify outliers. One of our free QuickCalc web calculators identifies outliers from a stack of values using Grubbs' method. Because this is one of our most popular calculators, we created a new analysis in Prism 6 to identify outliers in a column of data.

- Perform many t tests simultaneously. Computing multiple t tests can be useful, so long as you correct for multiple comparisons. Prism 6 has a new analysis to perform one t test per row of a data table (with replicates placed side-by-side). It corrects for multiple comparisons either by using either a more stringent definition of statistical significance or controlling the False Discovery Rate (FDR). You can also choose not to correct for multiple comparisons.

- More graphing choices. Prism 6 offers options to automatically graph ranks of nonparametric tests, and differences for paired t test and repeated measures ANOVA.

- Browne and Forsythe test. To test equality of variances in one-way ANOVA, Prism 6 computes both the Browne and Forsythe test as well as the Bartlett test (which previous versions computed).

- Method of Pratt. There are two ways to compute the Wilcoxon matched-pairs test when some of the pairs are identical, so the difference is zero. Prism 6 offers both choices. The new choice is the method of Pratt for tied rows.

Simulations and Monte-Carlo analyses

Simulations can be useful even when you just simulate one data set, and view the graph and analysis.Prism 5 let you simulate XY data. Prism 6 now let's you also simulate column data and 2x2 contingency tables. For

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XY and Column data, Prism 6 can include not only Gaussian random scatter, but also scatter computed from a Poisson or binomial distribution.

Simulations are even more useful when you repeat the simulation many times, and tabulate the results. Prism 6 makes this possible with a new Monte Carlo simulation analysis that makes it easy to tabulate the results of many simulations. First simulate a data table and run an analysis to analyze that table. Then run the new Monte Carlo analysis. Specify how many simulations you want to run, and which analysis parameters to tabulate. You can also define a "hit", as perhaps a P value less than 0.05, or a confidence interval including a theoretical value. The results of the Monte-Carlo analysis include a table with all the tabulated data (that you can analyze further), and a table of the number of simulations that were hits.

3.2.3 What's new? Multiple comparisons

- Multiplicity adjusted ("exact") P values can be reported with Bonferroni, Tukey, Dunnett, Dunn, or Holm-Sidak multiple comparisons testing following one- or two-way ANOVA. An adjusted P value is an "exact P value" reported for each comparison, but its value depends on the number of comparisons.

Tukey's multiple comparisons test	Mean Diff.	95% CI of diff.	Significant?	Summary	Adjusted P Value
Treated vs. Control	38.80	20.49 to 57.11	Yes	***	0.0003
Treated+Antagonist vs. Control	2.600	-15.71 to 20.91	No	ns	0.9245
Treated+Antagonist vs. Treated	-36.20	-54.51 to -17.89	Yes	***	0.0005

- Fisher's unprotected Least Significant Difference (LSD) comparisons are a second approach to report "exact P values" following ANOVA. This method does not correct for multiple comparisons.

- New multiple comparisons test. Holm-Sidak has more power than the Tukey or Dunnett methods, but cannot provide confidence intervals.

- Dunnett's test can now can be computed with 256 groups. Prism 5 was limited to 20 groups.

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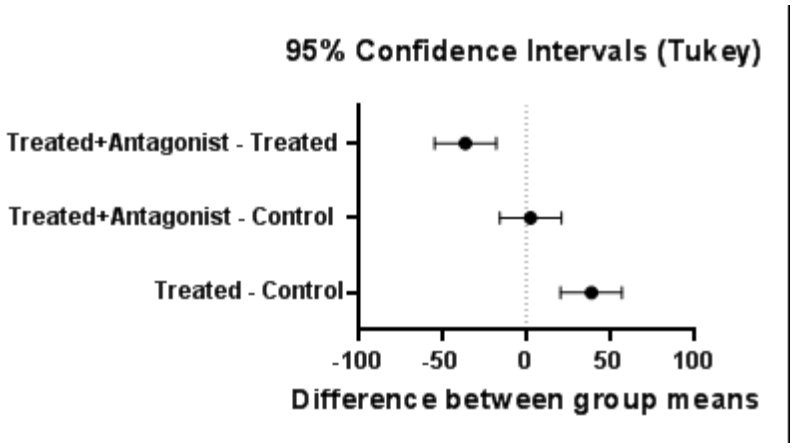
- For all multiple comparisons that create confidence intervals, check an option and Prism will create a new graph with those multiple comparisons confidence intervals.



- Multiple comparisons after one-way repeated measures ANOVA, without assuming sphericity. Prism 6 can compute confidence intervals from repeated measures one-way ANOVA using two different methods. The new method does not assume sphericity. Instead of using the pooled variation from all the groups (which depends on the sphericity assumption), the multiple comparisons are computed using only the data in the two treatments being compared. The calculations still account for the total number of comparisons, but don't pool the variation in all groups.

- When performing multiple comparisons testing, it can make sense to use a overall (familywise) significance threshold higher than 0.05. Prism 6 lets you set it to 0.1.

- Main and simple effects for multiple comparisons after two-way ANOVA.

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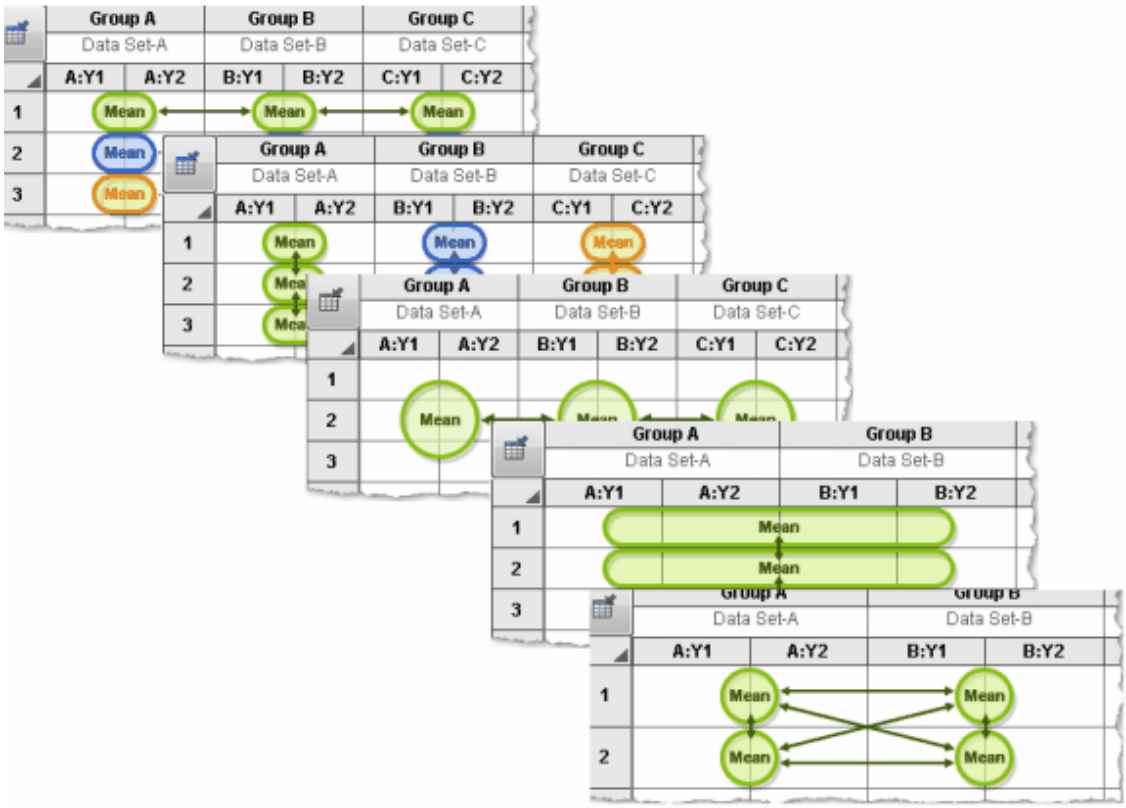

3.2.4 What's new? Regression

Simpler

- Much easier interpolating. Many people use nonlinear regression for the purpose of interpolating values from standard curves. If that is your goal, most of the options provided in the nonlinear regression dialog are neither required or helpful. Prism 6 offers a new analysis just for interpolating curves. It offers only essential options, so is super easy to use.

- Plot functions to understand them. Before using an equation as a model to fit to data, it is wise to first understand it. A great way to do this is to plot the function and see how it changes when you alter the parameters. Prism plot functions using an analysis called Generate a family of curves. It addition to (or instead of) plotting the function itself, Prism 6 can now also plot the first and second derivative of the function, and its integral.

Fit more kinds of models with nonlinear regression

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- Implicit and differential equations. It is no fun to struggle with algebra and calculus to express a model as an equation that defines Y as a function of X and parameters. It can even be impossible. Instead express your model as a differential equation (enter the equation that defines dY/dX) as or an implicit equation (an equation where Y appears on both sides of the equals sign).

- Write more complex models. Prism 5 let's you define different models for different data sets by designating certain lines in the equation to only apply to a certain data set. For example, a line in the equation preceded with <B> applies only to data set B. Prism 6 extends this syntax to allow more complex equations. Precede a line with <A:D> for it to apply only to columns A-D, or with <A:K,2> to make it apply to every second data set between A and K (A, C, E, G, I, K).

- New weighting choice. When fitting a model to data with nonlinear regression, it is important to weight the data appropriately. This choice is often ignored, but it can affect the regression results. Prism always offered several choices for weighting. Prism 6 offers a new weighting choice, weighting by $1/Y^K$. where K is a constant you enter on the weighting tab of the nonlinear regression dialog.

Additional results with nonlinear regression

- Hougaard's skewness. When you write a user-defined equation to fit to data with nonlinear regression, you can choose to express the parameters in multiple ways. For example, choose between fitting a rate constant or a half life. Hougaard's measure of skewness can help you choose the parameterization where the uncertainty is closer to symmetrical so the confidence intervals will be more accurate.

- Adjusted R^2. Prism reports the adjusted R^2 which takes into account the number of degrees of freedom, and so can be compared between models with different numbers of parameters.

Linear regression

- Convert from linear to nonlinear regression with one click. Linear regression can be viewed a special case of nonlinear regression. Prism's nonlinear regression analysis can be used to fit a straight line, and there are more than a dozen reasons why you might want to do so. But few people think of using the nonlinear regression analysis to fit a

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straight line. Prism 6 makes it easier to switch – simply click the "More choices" button on the linear regression dialog.

- Copy the linear regression equation. Prism always reported the best-fit values for the slope and intercept, but not in the form of an equation. Prism 6 now reports the equation for the line, ready to copy and paste onto a graph or into a manuscript.

Linear reg.		A	B
		Control	Treated
		Y	Y
1	Best-fit values		
2	Slope	12.42 ± 0.5679	17.96 ± 0.8684
3	Y-intercept when X=0.0	17.42 ± 3.471	28.48 ± 5.446
[illegible]	X-intercept when Y=0.0	[illegible]	-1.585
23			
24	Equation	Y = 12.42*X + 17.42	Y = 17.96*X + 28.48

3.2.5 What's new? Time savers

General time savers

- **Wand to analyze data.** After entering data onto an empty data table, you may wish to analyze these new data exactly as you have analyzed another data table. Prism has always provided a tool to do this, but you probably never found it (it used to be called Applying a Method). Prism 6 introduces the Wand (Wizard to ANalyze Data 175) button. Click it to analyze (and graph) a new data table just like you already analyzed (and graphed) an existing table.

- **Choose your own defaults.** Many dialogs now a have checkbox to make your choices on that dialog (or tab) become the defaults when you use the dialog in the future.

- **Rename while duplicating a family.** A commonly used time saver is to duplicate a sheet with a family, and then change the data in the new copy. Prism 5 let you specify a prefix, which then preceded all the newly created sheet names. When the family only has one data table, Prism 6 lets you entirely rename that data table.

- **Faster saving.** Prism 6 Windows saves to a networked drive many times faster than did Prism 5. Prism 6 Mac saves over a SMB connection much more quickly.

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- **Faster closing**. Prism 6 Windows can close a large file much more quickly than did Prism 5.

Make graphs faster

- **Easier to choose the right type of graph.** Prism 6 no longer asks you to pick the graph type on the Welcome (File..New) dialog, which leaves the Welcome dialog less cluttered and easier to understand. Instead, you choose the graph type the first time you view a new graph. Choose a graph type by choosing among a set of icons, and preview how that kind of graph looks with your data.

- **Format several data sets at once.** The Format Graph dialog in Prism 5 always let you either change one data set at a time, or click the "all" button to change all data sets at once. Prism 6 also lets you choose a defined subset of data sets at once. For example, you could select data sets A, C, E, and G and change all of those data sets to use a dotted line. Then choose B, D, F and H, and make those lines solid.

- **Click the apply button to see changes without closing the Format Graph or Format Axes dialog.** The Format Graph and Format Axes dialogs are very powerful, and give you a huge number of options to change the appearance of your graph. To avoid the need to click OK, then go back to the dialog to make more changes, simply click the new Apply button and you'll see the effect of the changes you made without closing the dialog.

- **View graphs faster.** An XY graph with many points appear on screen faster when you switch to it, and is regraphed much faster after you make any changes in the Format Axes or Format Graph dialogs or if you move the graph on a page or stretch its axes.

- **Instantly switch between black and white, colors, and shades of gray**. You can bring up the color scheme dialog if you want to choose among many color schemes. But Prism 6 makes it super fast to switch between color and black and white (includes shades of gray).

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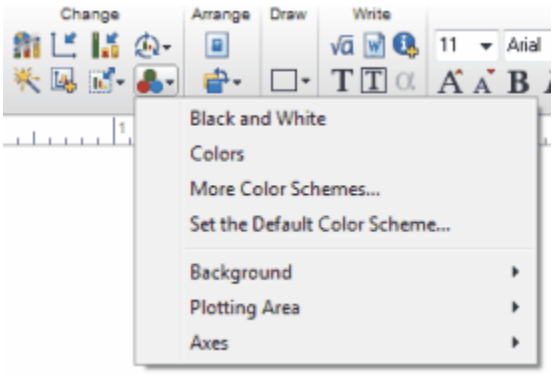

Easier to navigate around Prism

- **Search for sheets.** Prism lets you organize projects the way you want to, with no limit to the number of sheets that a project can contain. But if you put hundreds of sheets into one file, you may have trouble finding the sheet you need. Prism 6 lets you search 195 within a project to find all sheets that include the specified text.

- **More galleries.** Prism 5 lets you view all graphs at once on a gallery. Ditto for data tables, info tables, analysis results and layouts. Prism 6 also lets you view an entire family of linked sheets in the gallery, or to see the entire set of search results (see above) as a gallery.

- **Crisper on screen graphics**. We've revamped how Prism Windows handles onscreen graphics. It won't affect how your graphs look when exported or printed, but graphs look much crisper on screen in Prism 6.

New choices in the Welcome dialog

- **Graph Portfolio to help you master Prism.** Click the Portfolio tab on the Welcome dialog to browse a portfolio of polished graphs. Open any of these graphs to explore how it was made.

- **Open files you forgot to save!** When you exit Prism (as with any program), it asks you whether you want to save changes to every open file. Have you ever clicked No by accident and lost your work? Not with Prism 6! You can open "unsaved" files from the Welcome dialog (unless you tell Prism not to keep them, or unless you waited more than three days).

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- **Launch two instances of Prism.** When you open Prism Windows, it is limited to use on one display. If you open several projects, each project is a window within the larger overall Prism window. With Prism 6, you can launch a second copy of Prism with its own windows. You can't launch the second instance from within Prism. Instead, double-click on the program icon.

- **Open files directly from LabArchives.** From the Welcome dialog of Prism 6, you can open a file directly from LabArchives, so don't need to first go to labarchives.com to download the file you want.With Prism 6, you can upload files directly to LabArchives 166 (introduced in Prism 5.04 and 5.0d). Prism 6 (but not Prism 5) also sends LabArchives a list of all words used in notes, titles, text boxes, etc, so you can search within LabArchives to find the file you need.

- **Easier to find the sample data sets.** Prism 5 introduced sample data sets as a way to learn Prism. Prism 6 makes these more obvious on the Welcome dialog, so more people will try them.

3.2.6 What's new? Data tables

- More columns 236. Prism 6 allows you to enter data in up to 256 data set columns. Prism 5 allowed only 104.

- More subcolumns. 236 When creating an XY or grouped table, Prism 6 allows up to 256 subcolumns per data set (compared to only 52 subcolumns with Prism 5). This lets Prism compute repeated measures two-way ANOVA with more subjects.

- Paste link data or results from Prism. 266 You've probably encountered situations where you need to copy values from a results table, and then paste onto a data table, perhaps using options in the Paste Special dialog to transpose or rearrange the values. Prism 5 could paste the values, but there was no link, so it was not possible to trace where the values were pasted from, and the pasted values did not update when the original data were edited or replaced. Prism 6 lets you paste link so values pasted onto the data table are linked to their source, and will automatically update.

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- Reformat a select set of points. 351 Select any block of data in a data table, right click, and choose Format Points to change the color (or size or shape...) used to graph that subset of points.

- Long column titles 244. With Prism 6, the length of column titles has no real limit. Prism 5 limited the length of column titles, and many people bumped into that limit.

- Multiple line titles. 244 Each row or column title can now have two or more lines of text.

- Bold, italics and underline. You may also now bold, italicize and underline text in row and column titles (you could always use superscript, subscripts and Greek).

- View all column titles at once 244. A new tab in the Format Data Table dialog of Prism 6 lets you see and edit all the column titles. This saves you from the scrolling back and forth to edit titles, which was especially tedious with XY or Grouped tables with many subcolumns.

3.2.7 What's new? Working with other programs

- **LabsArchives.** Prism 6 integrates better with LabArchives. As in Prism 5, click "LabArchive it" to upload files directly to LabArchives. Now, , Prism also sends LabArchives a list of all words used in notes, titles, text boxes, etc. That mean you can search within LabArchives to find the file you need. From the Welcome dialog of Prism 6, you can open a file directly from LabArchives. There is no longer a need to first go to labarchives.com to download the file you want.

- **Faster TIFF**. Exporting TIFF files at 1200 dpi from Prism Windows is much faster and more reliable (doesn't lead to out of memory messages).

- **Smaller TIFF**. Prism Windows can now compress TIFF files at 600 or 1200 dpi, and compress even when you choose the CMYK color model (not allowed in Prism 5 Windows)

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- **More exporting choices.** When compressing TIF files, choose between the LZW or packbits scheme. Choose either a RGB or CMYK color model for PNG files. Choose higher resolution output (up to 1200 dpi) with JPG.

- **No popup dialog after exporting**. After exporting a graph, layout or table, Prism 5 would always pop up a dialog offering to open the folder to which the file was exported. When it is done exporting, Prism 6 doesn't show that extra dialog. Instead, Prism 6 lets you choose, in the export dialog, whether to open the folder after exporting. You can make that choice a default for the future.

- **More importing choices**. Prism 6 Windows can import more kinds of images onto a graph or layout. Here is the complete list:

  Windows Enhanced Metafile (*.emf)
  Windows Metafile (*.wmf)
  TIFF (*.tif;*.tiff)
  JPEG (*.jpg;*.jp2;*.j2k;*.jpx)
  Portable Network Graphics (*.png;*.mng)
  Windows Bitmap (*.bmp)
  Graphics Interchange Format (*.gif)
  Scalable Vector Graphics Format (*.svg)
  PC PaintBrush (*.pcx)
  TruvisionTarga Format (*.tga)
  Microsoft Paint Format (*.msp)
  PhotoShop 3.0 Format (*.psd)
  Windows Icon and Cursor Formats (*.ico)
  Macintosh Pict (*.pct;*.pict)

- **Choices when copying excluded values.** Prism lets you exclude values on the data table, where they appear in blue italics. These values are ignored when Prism makes graphs and analyzes data. Prism 6 offers three choices for how excluded values should be copied or exported. 1. Like other values, ignoring the fact that they are excluded. 2.Followed by an asterisk. 3. As a blank space instead of the value. When exporting, this choice is set in the export dialog. When copying to the clipboard, the choice is set in the File & Printer tab of Preferences.

- **Choose whether to use period or comma as the decimal separator.** When you copy data to the clipboard, Prism 5 used the Windows or Mac control panel settings to decide whether to use a comma or period (point) as the decimal separator. Prism 6 lets you choose in the Preferences dialog. This lets scientists who live in countries where a comma is commonly used still use a period when

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copying data out of Prism for pasting into a manuscript that will be read in other countries.

- **LinkBack support.** When you paste a graph or layout created with Prism 6 Mac into some other programs, LinkBack let's you double-click on the embedded graph to return to Prism for editing. This works similarly to OLE on Windows. But while OLE is part of Windows and supported by Microsoft, LinkBack is not part of OS X and is not supported by Apple. It only works with selected Mac apps, and does not work with Word, PowerPoint or Keynote.

3.2.8 What's new? Parts-of-whole data

- Parts of whole tables. 218 Prism has always created structured data tables, and Prism 6 adds a sixth kind of table: Parts of Whole. As the name suggests, this table is used for the kind of data where it makes sense to sum all the values in a data set column, and divide each value in the table into this total.

- Pie charts and more. 486 Each data set column in the parts of whole table can become its own pie chart, and each value represents one slice of the pie. Prism will graph column A automatically. To graph the other columns, use New...Graph of existing data. Prism can also plot these kind of data as a donut plot, stacked bar plot, or a percentage dot plot.

- A new fraction of total analysis 330 computes each value in a table as a fraction or percent of its column total. In a parts of whole table, each value represents one slice in a pie chart defined by the sum of all the values in that column, so this analysis computes the fraction (or percentage) of the pie represented by each slice. It can also be used with contingency (or Column, XY or Grouped, if needed and if there are no subcolumns) tables to compute each value as a fraction of its column total, its row total, or the grand total.

- Compare an observed categorical distribution with an expected distribution using either the chi-square test (any number of categories) or the binomial test (works only with two categories).

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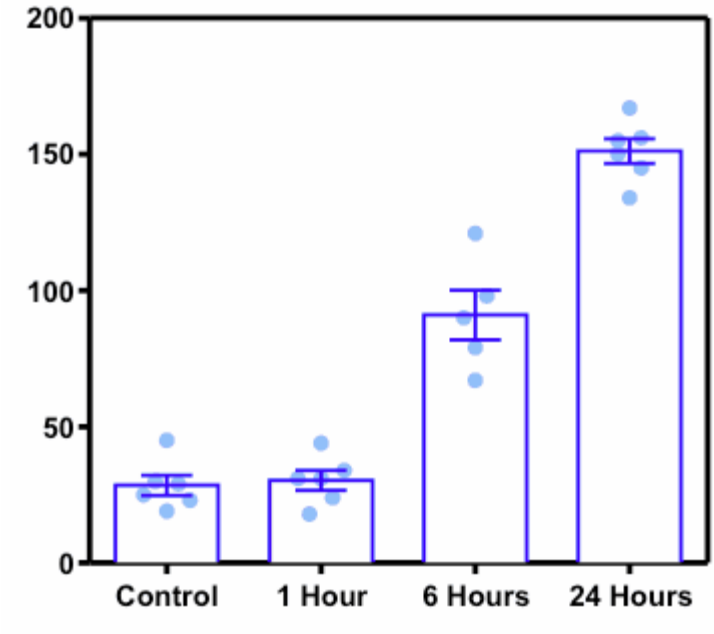
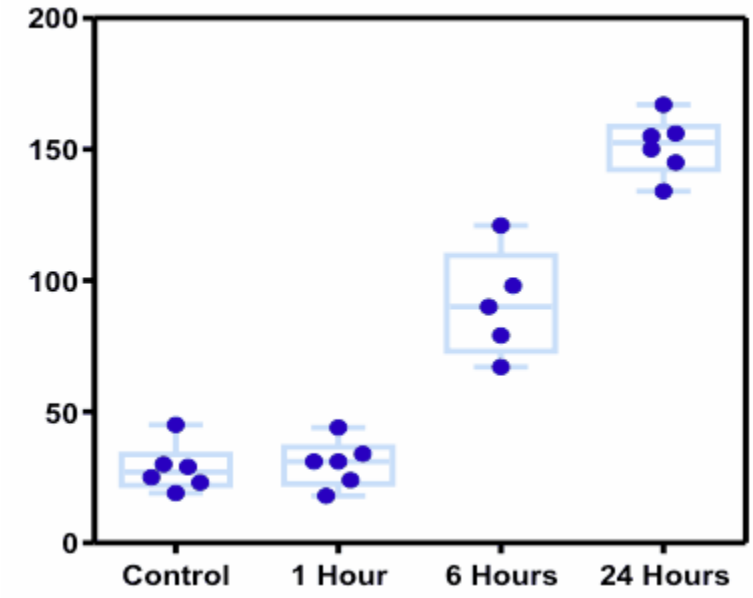
3.2.9 What's new? Column graphs

Superimpose individual data points with bars



Superimpose individual points on a box-and-whiskers plot



Separate groups of columns with a line

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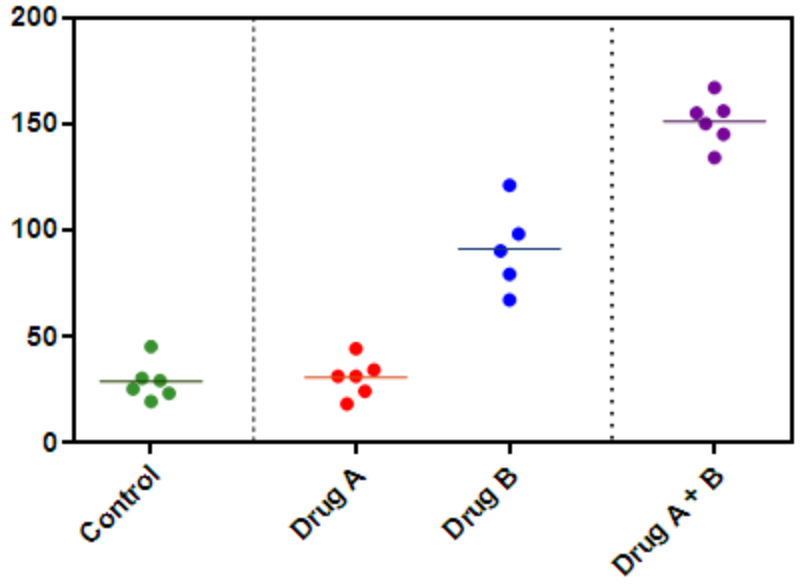
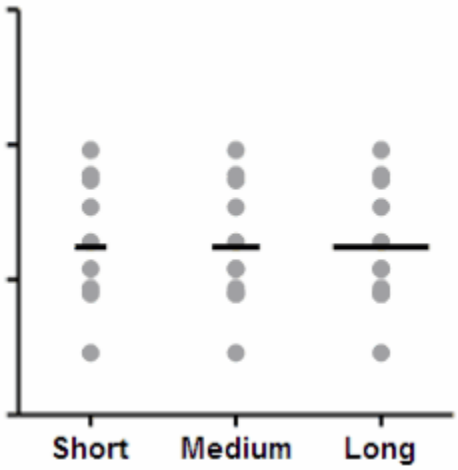


Control the length of the mean or median line in a scatter plot



Connect column means with lines

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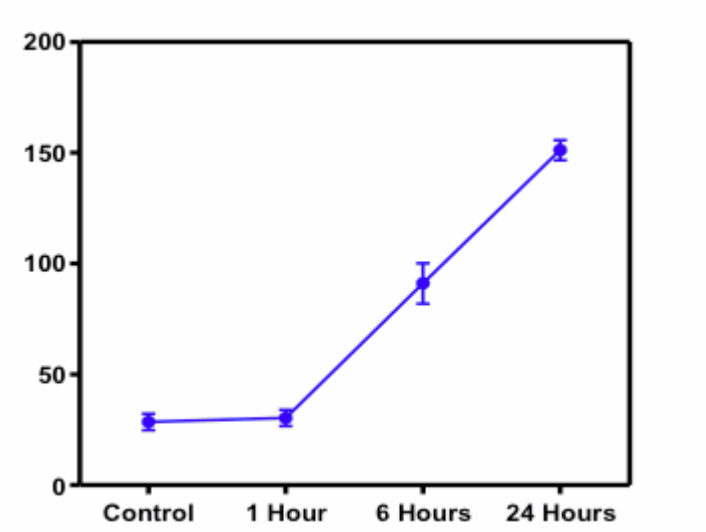

3.2.10 What's new? XY Graphs

- Depth charts. 554 When you assign a graph to a layout, you can specify that it be rotated 90 degrees. This essentially creates an XY graph where the independent (X) variable is shown on the vertical axis. As the graph's name suggests, this kind of graph is used in fields where the independent variable is depth, which is naturally shown on the vertical axis.

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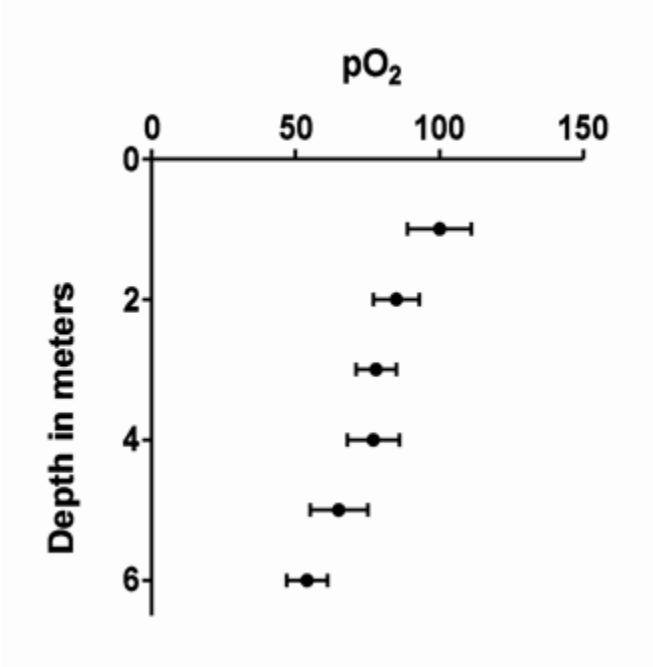
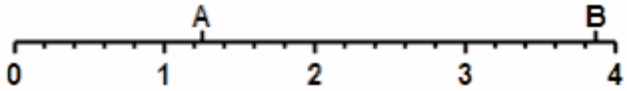


- Label both sides of the axis. 503 Place additional ticks and labels across the axis from the regular numbering. This is helpful, for example, when X is time, but you also want to label particular times when an experimental intervention was performed.



- Faster graphing. 411 Regenerating graphs with tens or hundreds of thousands of points can be slow. If you are impatient, Prism 6 lets you specify that a graph only show one out of every K points (you specify K), to speed up graphing on screen. It also lets you work on the graph (move things around, add text or drawings, change axis properties, etc.) as the data points are plotted on screen.

- Create a graphs with only a right Y axis. 358 Prism has always made it easy to add a right Y axis as a second axis. But it has been difficult to create a graph with a single Y axis positioned on the right side. To do this with Prism 5 can requires positioning the "left" (only) Y axis in on the right side of the graph, and then assigning data sets to the “left” axis, even though it is on the right side of the graph. Confusing! Prism

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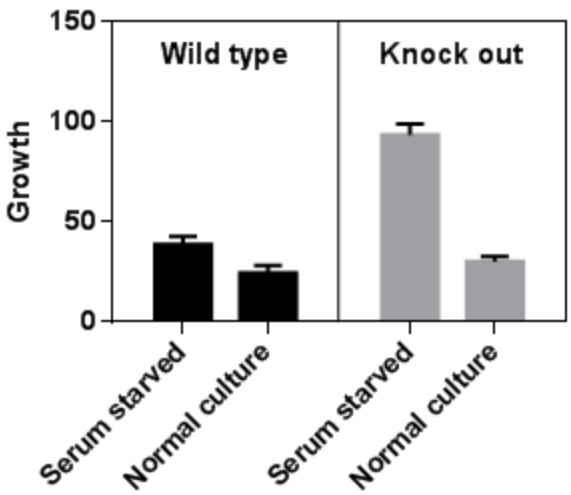
6 makes this more straightforward. Turn off the left Y axis, and create a right Y axis to which you assign data sets.

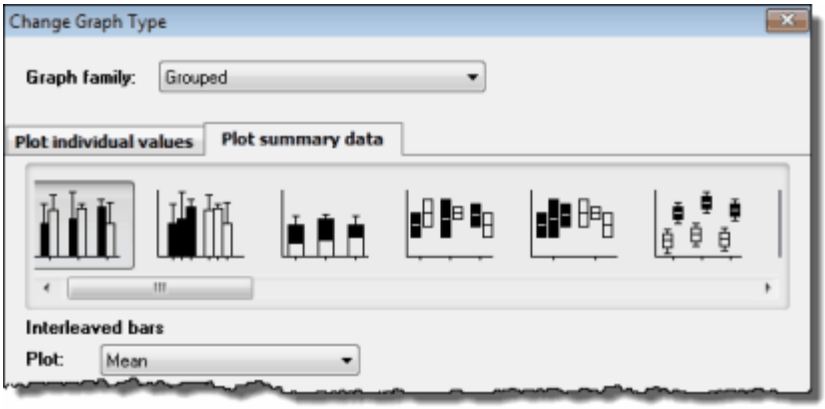
- More subcolumns. Prism 6 allows up to 256 subcolumns for replicates. Prism 5 allowed only 52.

3.2.11 What's new? Grouped graphs

- Draw lines between groups 445.



- More easily create grouped low-high, box-whiskers, and scatter graphs. 439



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- More subcolumns. Prism 6 allows up to 256 subcolumns for replicates. Prism 5 allowed only 52.

3.2.12 What's new? Layouts

- Unlinked graphs. 546 Prism 6 lets you assign a graph to a layout as an unlinked picture, that won't update if the data are edited or replaced, or if the graph is altered. One use for this is if you want to make several versions of a graph sequentially, and place each on a layout.

- Resize graph to match length of X axis 353. The resize graph dialog in Prism 5 lets you change the graph size to make the entire graph object have a specified width. But sometimes your goal is to match the length of axes, rather than the size of the entire graph object (including labels). Prism 6 now lets you specify the desired length of the X axis, and the rest of the graph changes size to meet that goal.

- Control the scaling factor on a layout 551. When you place a graph on a layout, its size usually changes. For example, the total length of a graph might be half as long on the layout as it is on the graph. We now term this value (50%) the scaling factor 551. If you then add a legend, drawing or image to the graph, Prism 6 will maintain the scaling factor, so the graph itself won't change size on the layout (but the graph plus its legend, drawings, etc will get larger). In contrast, Prism 5 maintained the size of the graph placeholder, so the graph itself would get smaller on the layout when you added a legend or text box or image to a graph.

- Enlarge or shrink an entire layout. 551 Enlarge or shrink an entire layout. Prism 6 has a new tool to as well as enlarging or shrinking an entire graph (which you could do in Prism 5).

- Easier to place a graph from one project into the layout of another. 546 Prism 5 allowed you to link a graph from one project into a layout of another. This lets you keep each project compact, and avoids the need to put all the data and results for one layout in one file. But that feature has been hard to discover, and used an extra popup dialog. Prism 6 makes it easier to discover and use by placing the choice on the first tab of the layout dialog.

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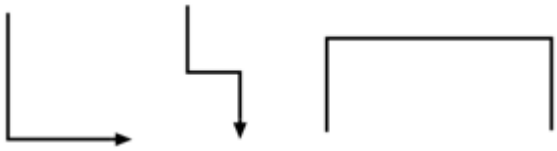
- Draw elbow and zig-zag lines. 564



- Place borders around graphs in layouts 551. After assigning a graph to a layout, you can crop it and/or define a border.

- Thinner lines. We've added a new choice to make lines and curves ¼ of a point thick. With Prism 5, the thinnest choice was ½ point. You won't notice the difference on screen, but you may notice the difference on printouts or high resolution exported files.

3.3 What was new in Prism 5?

In case you are upgrading from Prism 4, the pictures below show the biggest improvements in Prism 5. For details, read this 16 page pdf document.

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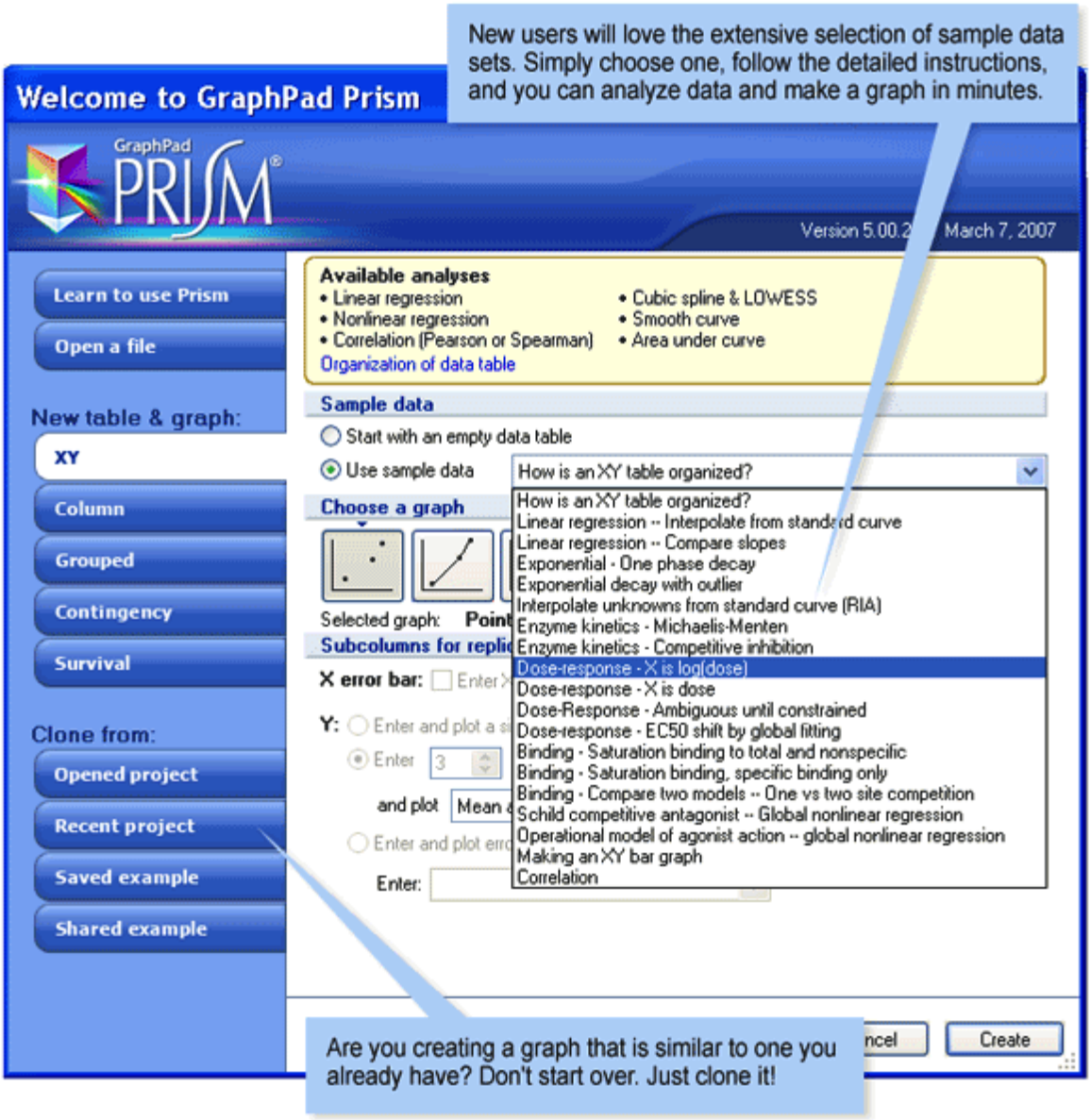

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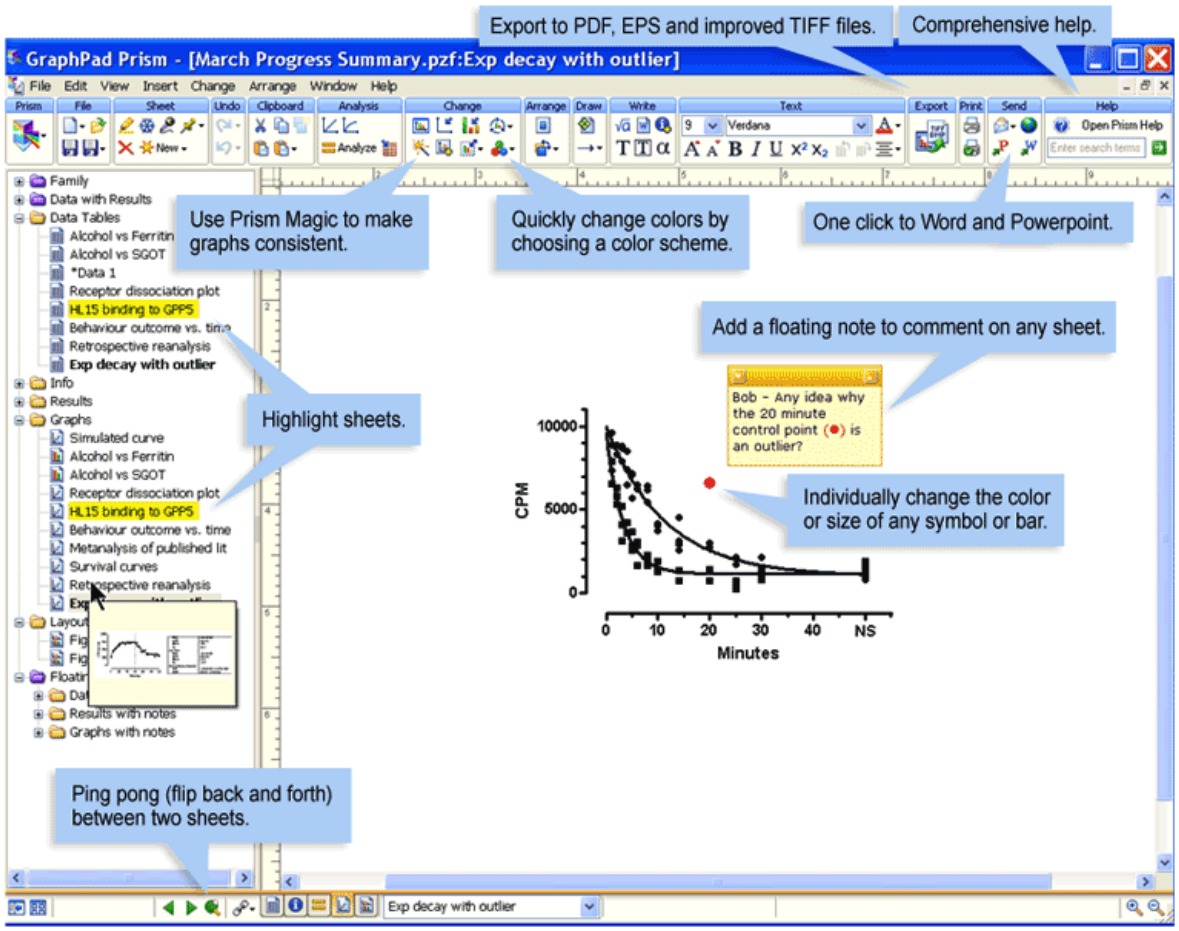
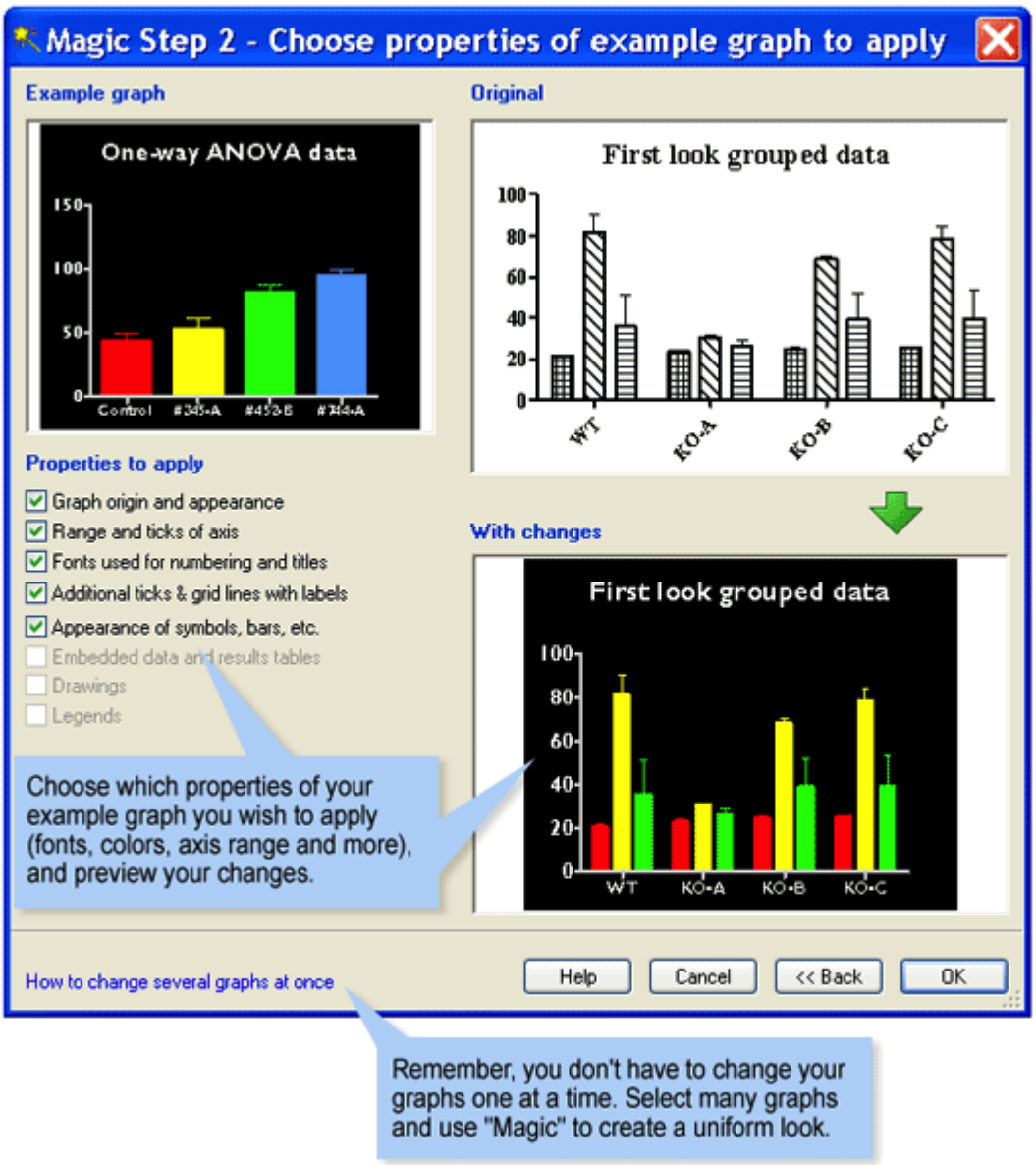

Export to PDF, EPS and improved TIFF files.
Comprehensive help.
GraphPad Prism - [March Progress Summary.pzf:Exp decay with outlier]
Use Prism Magic to make graphs consistent.
Quickly change colors by choosing a color scheme.
One click to Word and Powerpoint.
Add a floating note to comment on any sheet.
Bob - Any idea why the 20 minute control point (●) is an outlier?
Highlight sheets.
Individually change the color or size of any symbol or bar.
Ping pong (flip back and forth) between two sheets.
CPM
Minutes



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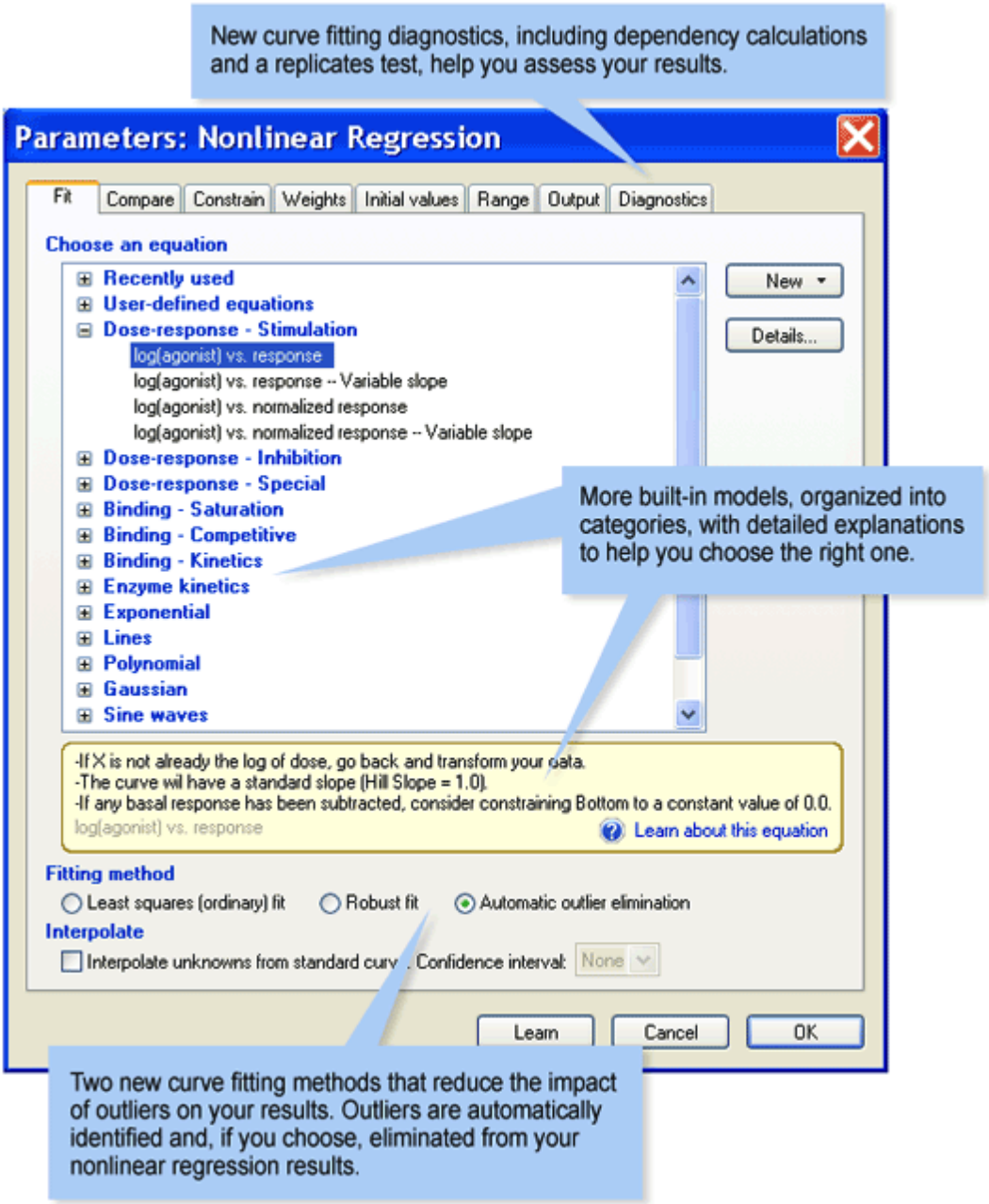

4 How Prism is unique

GraphPad Prism is very different than other

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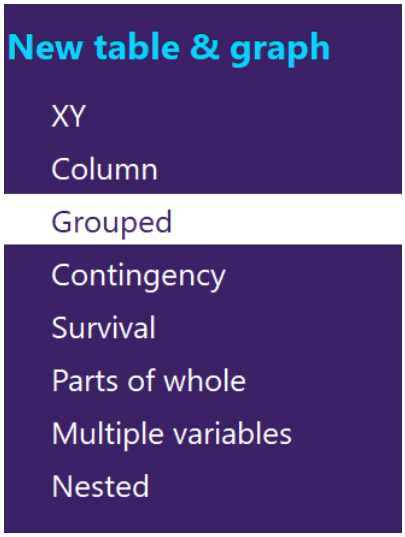
scientific graphing programs. As you start to use Prism, be sure to notice these four unique aspects of Prism.

- Organized data tables 96
- Everything is hot linked 100
- A complete record of your work 101
- Helps you learn data analysis 99

4.1 Organized data tables

Formatted data tables simplify graphing

Unlike spreadsheet programs, and other scientific graphing programs, Prism's data tables are structured or formatted. Whenever you create a new data table, choose one of seven table types. This makes it much easier to create appropriate graphs and to choose suitable analyses.



Enter SD or SEM values computed elsewhere

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If you computed error values elsewhere, enter them onto labeled (SD or SEM) subcolumns. Prism's analyses (i.e. t test, ANOVA, regression) will take into account the SD (or SEM) and sample size.

Table format: Grouped		Group A			Group B		
		Control (Vehicle)			Treated (10 µg/kg)		
		Mean	SD	N	Mean	SD	N
1	Wild type	21.00	2.00	3	81.33	15.63	3
2	Knock-out A	23.50	0.71	2	30.67	1.53	3
3	Knock-out B	24.33	3.06	3	68.33	3.06	3

Create error bars from raw data

Enter the raw data (i.e. triplicates), and Prism will automatically compute and plot the error bars. You can instantly switch between plotting the raw data, or plotting mean with SD, SEM, confidence interval or range.

	X	Group A			Group B		
	Minutes	Control			Treated		
	X	A:Y1	A:Y2	A:Y3	B:Y1	B:Y2	B:Y3
1	1.0	8887	7366	9612	6532	7905	7907
2	2.0	8329		8850	5352	5841	6277
3	3.0	7907	8810	8669	5177	4082	3157

Fit a family of curves at once

Place data for multiple data sets side-by-side on an organized data table, and fit them all at once. You can fit the same model separately to each data set, use global nonlinear regression to share parameter values among data sets, or fit different models to different data sets.

	Nonlin fit Table of results	A Control	B Treated
1	**One phase decay**		
2	**Best-fit values**		
3	Y0	9992	9593
4	Plateau	987.0	1154
5	K	0.08927	0.3042
6	Half Life	7.765	2.278
7	Tau	11.20	3.287
8	Span	9005	8440
9	**Std. Error**		
10	Y0	363.7	605.5
11	Plateau	360.3	161.5
12	K	0.01159	0.03446
13	Span	390.6	580.8
14	**95% CI (profile likelihood)**		
15	Y0	9301 to 10738	8419 to 10967
16	Plateau	201.0 to 1638	813.2 to 1480
17	K	0.06862 to 0.1134	0.2387 to 0.3862
18	Half Life	6.110 to 10.10	1.795 to 2.903
19	Tau	8.815 to 14.57	2.589 to 4.189
20	**Goodness of Fit**		

Easily handle missing and excluded values

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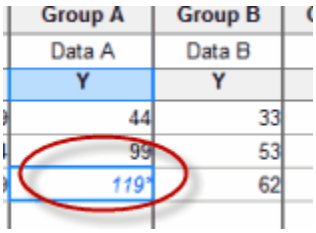
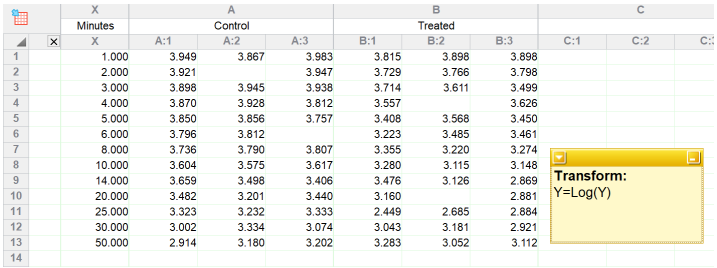
Using a command on the View menu (or via right clicking, or a toolbar button) exclude selected values. Excluded values show on the data table in blue italics but are omitted from analyses and graphs. You can also leave a cell blank to show that its value is missing. Prism treats missing and excluded values identically, and never treats a missing or excluded value as if you entered zero.



Group A	Group B
Data A	Data B
Y	Y
44	33
99	53
119	62

Computed values are kept separate from raw data

Prism includes built-in analyses to transform or normalize your data, or to subtract (or divide by) a baseline. Prism leaves your raw data alone, and places the calculated values on results tables. Raw data tables have a black grid. Results tables have either Green grids (when they can be analyzed further or graphed) or red grids.



	X	A			B			C		
	Minutes	Control			Treated					
	X	A:1	A:2	A:3	B:1	B:2	B:3	C:1	C:2	C:3
1	1.000	3.949	3.867	3.983	3.815	3.898	3.898			
2	2.000	3.921		3.947	3.729	3.766	3.798			
3	3.000	3.898	3.945	3.938	3.714	3.611	3.499			
4	4.000	3.870	3.928	3.812	3.557		3.626			
5	5.000	3.850	3.856	3.757	3.408	3.568	3.450			
6	6.000	3.796	3.812		3.223	3.485	3.461			
7	8.000	3.736	3.790	3.807	3.355	3.220	3.274			
8	10.000	3.604	3.575	3.617	3.280	3.115	3.148			
9	14.000	3.659	3.498	3.406	3.476	3.126	2.869			
10	20.000	3.482	3.201	3.440	3.160		2.881			
11	25.000	3.323	3.232	3.333	2.449	2.685	2.884			
12	30.000	3.002	3.334	3.074	3.043	3.181	2.921			
13	50.000	2.914	3.180	3.202	3.283	3.052	3.112			
14										

Transform:
Y=Log(Y)

You'll never confuse raw data with calculated results. You'll never wonder how values were computed.

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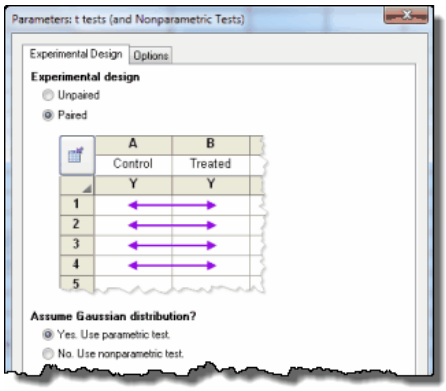
4.2 Data analysis for scientists, not statisticians

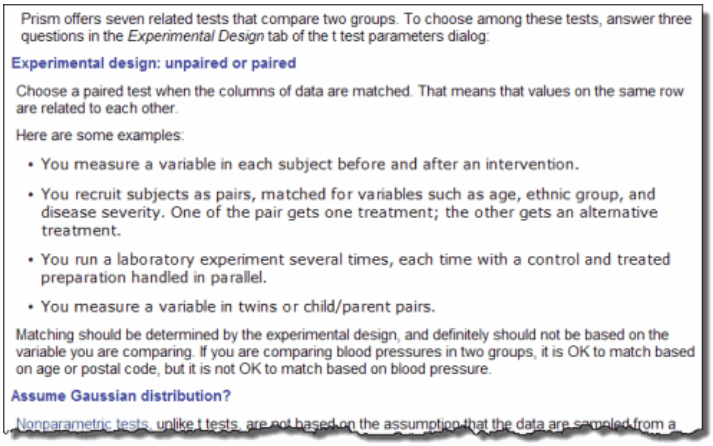
Understandable analysis dialogs

Prism presents analysis choices in clear language, and avoids statistical jargon.



Statistical help when you need it

Consult Prism's comprehensive online help to review the basic principles of data analysis, and to understand your analysis choices.



Prism offers seven related tests that compare two groups. To choose among these tests, answer three questions in the *Experimental Design* tab of the t test parameters dialog:

Experimental design: unpaired or paired

Choose a paired test when the columns of data are matched. That means that values on the same row are related to each other.

Here are some examples:

- You measure a variable in each subject before and after an intervention.
- You recruit subjects as pairs, matched for variables such as age, ethnic group, and disease severity. One of the pair gets one treatment; the other gets an alternative treatment.
- You run a laboratory experiment several times, each time with a control and treated preparation handled in parallel.
- You measure a variable in twins or child/parent pairs.

Matching should be determined by the experimental design, and definitely should not be based on the variable you are comparing. If you are comparing blood pressures in two groups, it is OK to match based on age or postal code, but it is not OK to match based on blood pressure.

Assume Gaussian distribution?

Nonparametric tests, unlike t tests, are not based on the assumption that the data are sampled from a

Review analysis check lists

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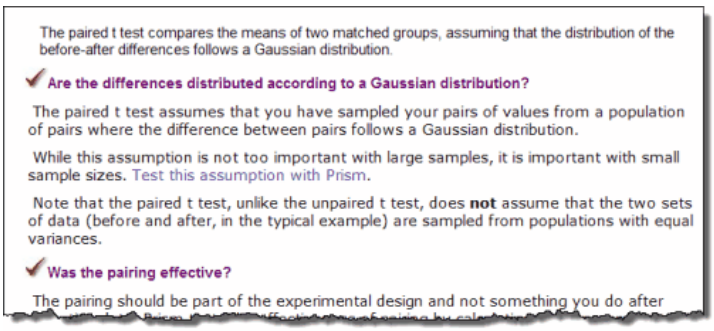
Once you've completed the analysis, review the accompanying analysis checklist to confirm you made the right choices.


The paired t test compares the means of two matched groups, assuming that the distribution of the before-after differences follows a Gaussian distribution.

Are the differences distributed according to a Gaussian distribution?

The paired t test assumes that you have sampled your pairs of values from a population of pairs where the difference between pairs follows a Gaussian distribution.

While this assumption is not too important with large samples, it is important with small sample sizes. Test this assumption with Prism.

Note that the paired t test, unlike the unpaired t test, does **not** assume that the two sets of data (before and after, in the typical example) are sampled from populations with equal variances.

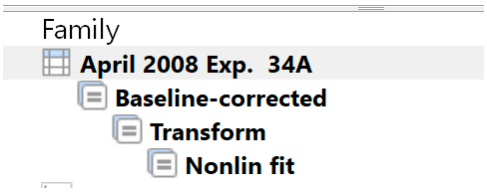
Was the pairing effective?

The pairing should be part of the experimental design and not something you do after

4.3 Everything is hot linked

Prism links data to results, graphs and layouts. It also lets you copy data or results from one part of Prism and paste link onto a data table. This has four advantages.

- When you fix a mistake in data entry, the results and graphs are automatically updated.
- If you replace the data, you;ll get new graphs and analyses of the new data.
- When you open a Prism file, you can retrace every step of every analysis, and review (or change) any of the choices. You'll never see a curve or a P value and wonder how it got there.



- After you've polished the analysis and graphing steps with data from one experiment, you don't have to repeat all those steps for a repeat experiment. Prism provides several ways to instantly analyze and graph a repeat experiment, without repeating any tedious steps and without requiring any scripting or programming.

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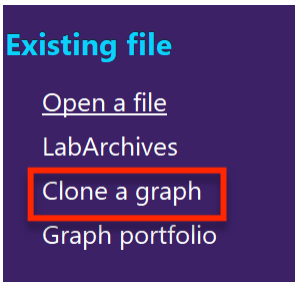
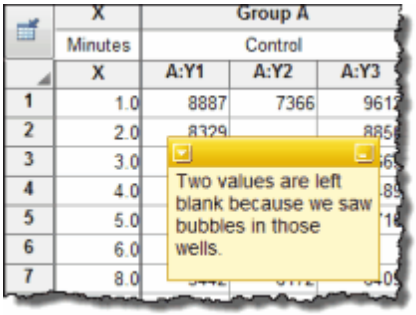


4.4 A complete record of your work

Annotate your experiments with floating notes

Add floating notes to data tables, results and graphs. These notes can be color coded.



Record experimental details in Info tables

Constant	Value
Experiment Date	4/27/2012
Notebook and page	2012-33
Protocol	Agonist stimulation
Lot Number	545-34
Reviewed by	TBO

Use Info tables to record dates, lot numbers, concentrations, etc. These values can be used as constants when transforming or analyzing data.

Highlight sheets you want to return to

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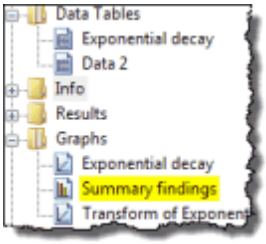

Highlight the pages that you want to review, or want a colleague to look at. Choose a different color highlight for different purposes.

Change the background color of selected data values or results

Select any cell or range of cells in data tables or results and apply a background color.

	X	Y
1	106	1
2	19	1
3	2	1
4	1	1
5	27	1
6	94	1
7	19	1
8	158	1
9	21	1

Save to the cloud with LabArchives

LabArchives.com enables researchers to store, organize, and publish their research data. Upload your Prism files directly to LabArchives, and open them (even from a different computer) directly from Prism's Welcome dialog.

Anyone can view a Prism file

You can send Prism files even to colleagues who don't own Prism. They can download the free 30-day trial. After the trial expires, it becomes a perpetual Prism viewer that lets your colleague view all parts of your file, including analysis choices.

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5 Getting started with GraphPad Prism

Prism is designed so you can just plunge in and use it. But you'll master Prism more quickly if you check out the tips listed here, and the guided examples of data analysis.

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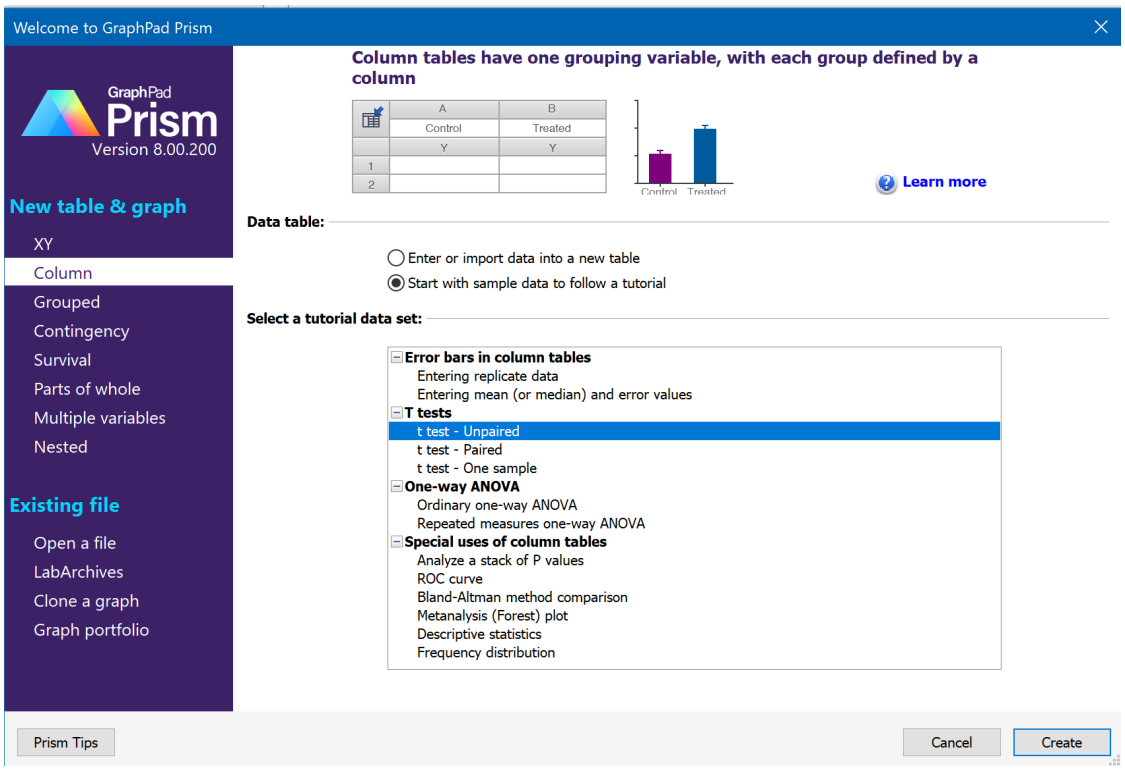
5.1 A brief tour of Prism

This five-minute tutorial will show you a bit about how Prism is organized.

1. When you start Prism, you'll see the Welcome (File..New) dialog. You'll see eight tabs representing the eight kinds of data tables. Click on the Column tab. Then choose to use sample data, and choose the sample data for an unpaired t test.



Notes:

- To use Prism effectively, you need to learn how to choose which of the eight types of data table 200 to select.
- Note the distinction between choosing sample data or creating an empty table into which you can enter or import data.

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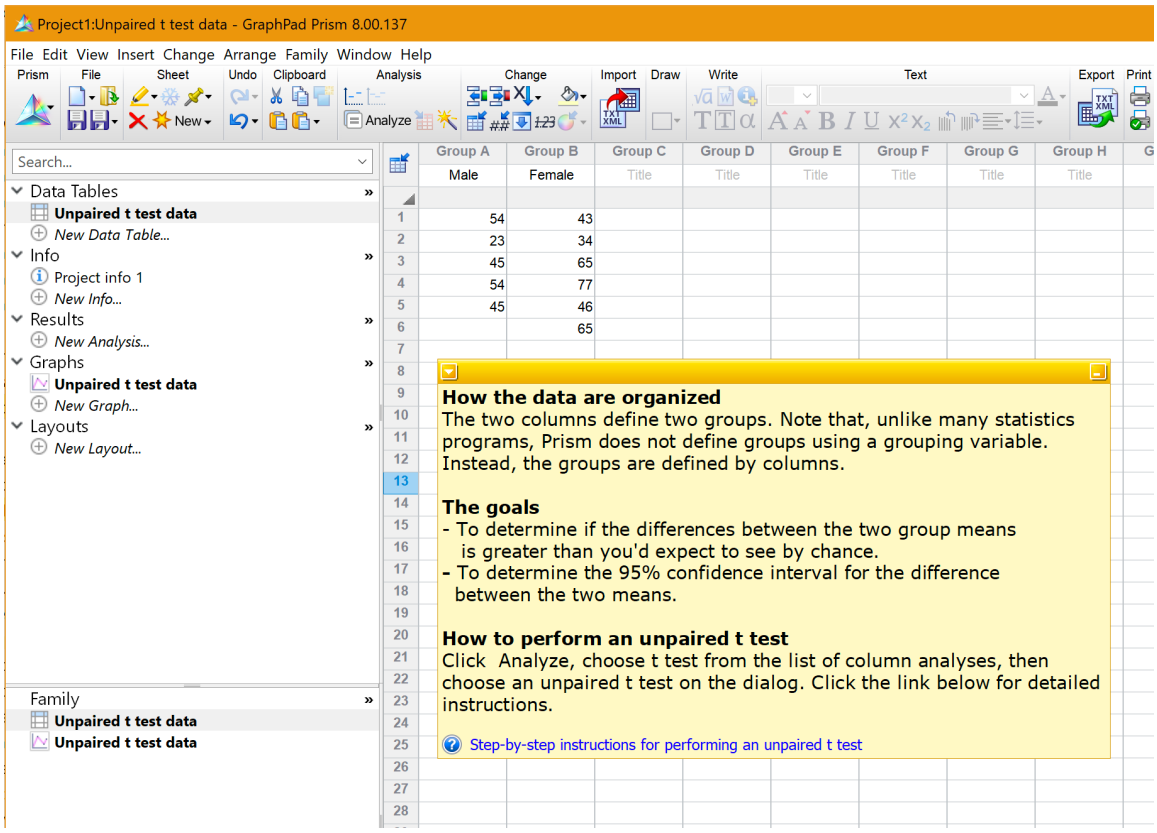
- Choosing the tutorial data for the unpaired t test only fills the table with data. You'll choose an analysis in the next step.

2. Note that the tutorial data comes with a floating yellow note that briefly explains the data format, and links to more detailed online help.



3. From the data table, click Analyze and then choose the t test analysis. Alternatively, click the t test shortcut button above the Analyze button.

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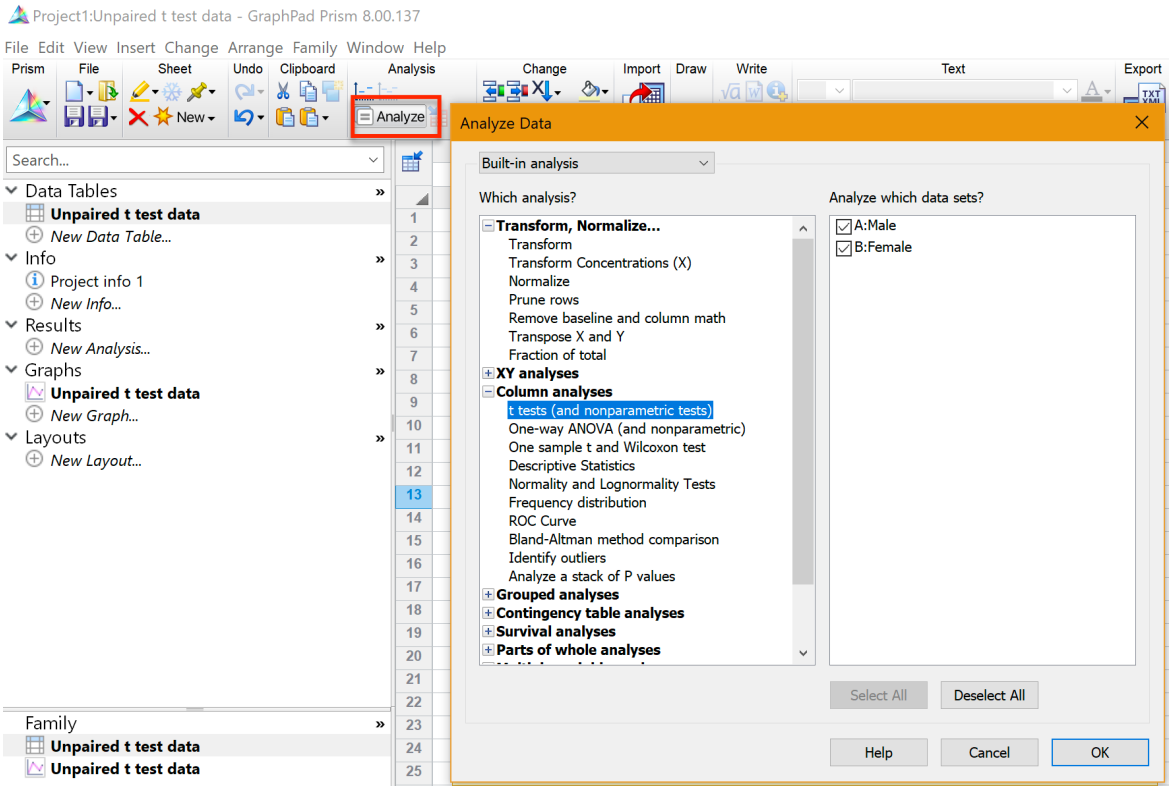

4. On the first tab of the t test dialog, confirm that the experimental design in unpaired and that you want to assume a Gaussian distribution and to perform an unpaired t test. For now, you can accept all the defaults on the second and third tabs. Click the Learn button to read explanations of all the choices.

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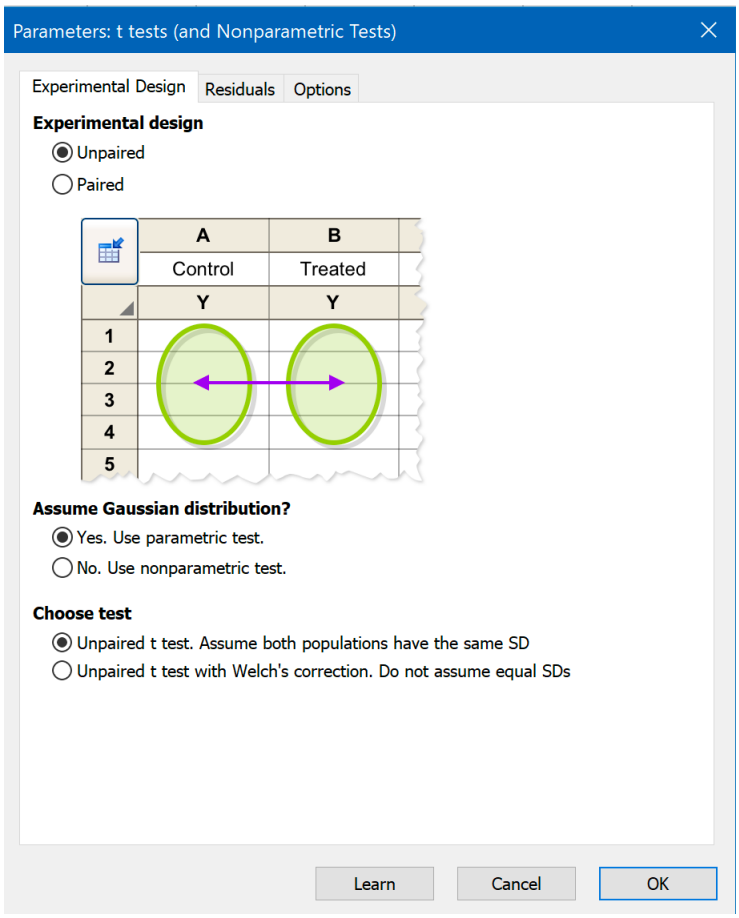

5. View the results. Click the analysis checklist button to help interpret the results. Click the Results button in the upper left corner to open the Analysis Parameters dialog to perhaps change to a paired or nonparametric test.

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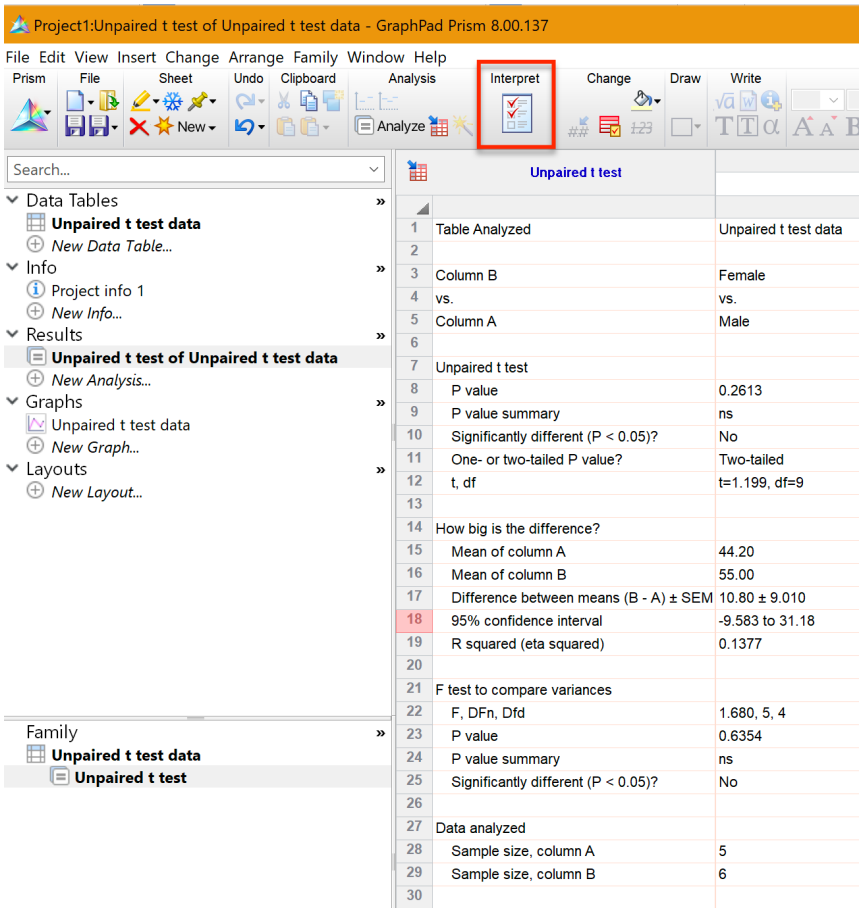

6. In the navigator on the left, click on "Unpaired t test data" in the graphs section. The Change Graph Type dialog will pop up. Choose the kind of graph you want, and see how that choice will look. We suggest choosing a Scatter plot, and plotting a line at the mean.

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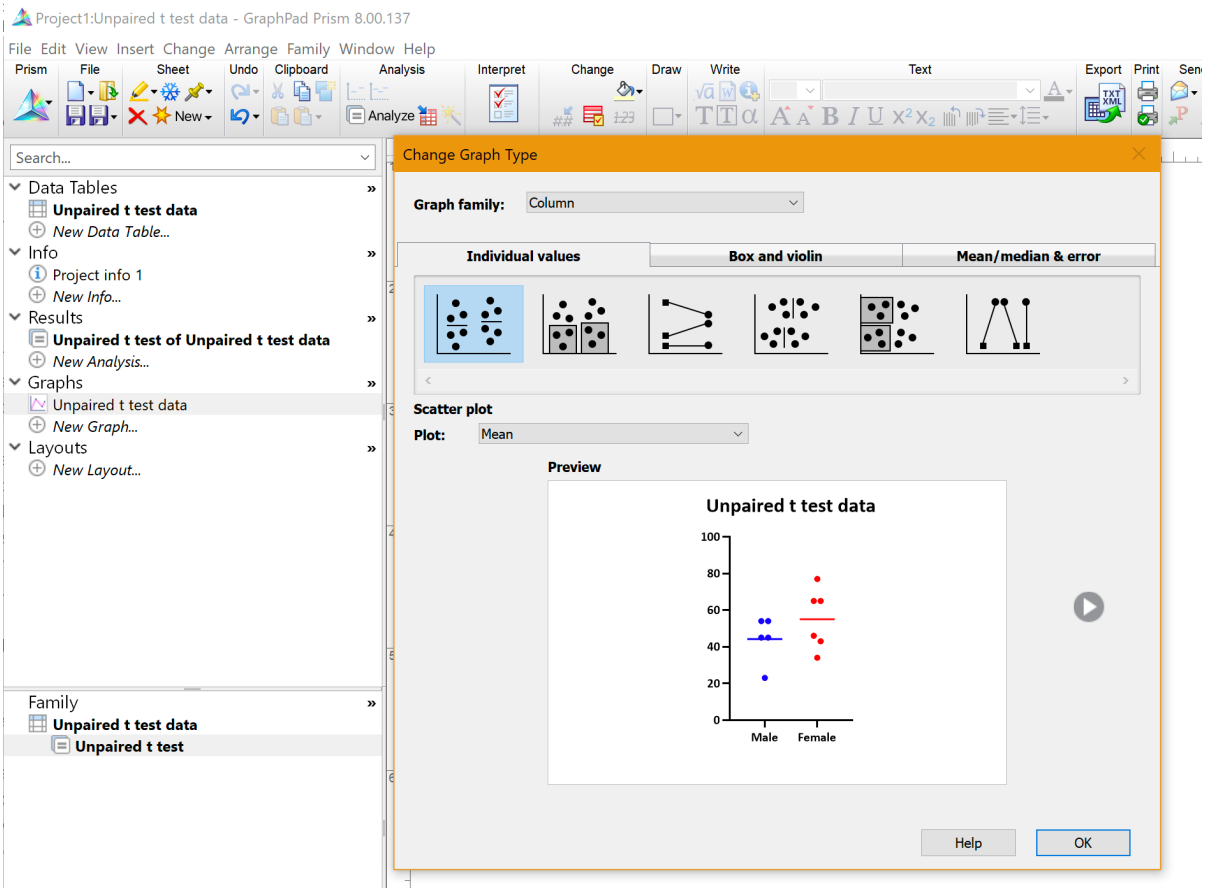

5.2 Essential concepts

To use Prism effectively, you need to understand these essential concepts:

Prism data tables are organized. It is essential to choose the right kind of data table.

Unlike Excel or most statistics programs, Prism's data tables are organized with a structure or format. To use Prism effectively, therefore, you must learn the distinction between the eight types of data tables 201. Don't try to choose the kind of table based on the kind of graph to make. That approach doesn't always work. Choose a table based on the organization of your data and the analyses you wish to perform.

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A Prism project can contain many data tables and graphs

A Prism project (another term for a Prism file) is not limited to a single graph or data table, but rather can contain up to 500 data tables, graphs, analyses, and page layouts.

Prism can automatically plot error bars from raw data

One of Prism's strengths is its ability to handle replicates and error bars. For XY and Grouped tables, replicates are placed in side-by-side subcolumns. For Column tables, replicates are stacked in each column.If you enter replicate values, Prism can plot either individual replicates or error bars. It can plot error bars from the replicates you entered automatically. You don't have to specify any calculations.

When you edit or replace data, analyses and graphs are automatically updated

Prism remembers the logical links between data tables, info sheets, results tables, graphs and layouts. When you edit or replace data, Prism automatically recomputes linked analyses and redraws linked graphs.

Analyses can be chained

Results tables can be analyzed further. From any results table with green grid lines, click the Analyze button. This lets you, say, first transform your data, and then fit a curve (nonlinear regression) to the results.

Results of analyses can be presented on multiple analysis tabs

Analysis tabs at the top of the results page let you see different parts of the results.

One table ≠ one graph

By default, Prism creates one graph for each data table you create, but this should not limit you. You can plot a table on multiple graphs. And you can plot data from multiple data tables on one graph.

Recycle your work

Once you've analyzed and graphed one data table, it is easy to repeat your work with new data by duplicating a family 171 or cloning a graph 173.

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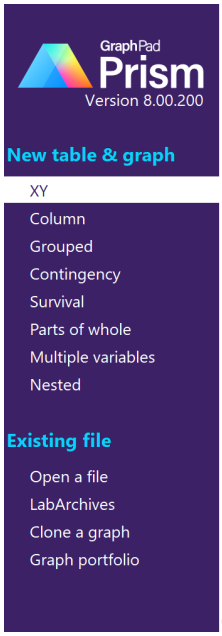
5.3 Welcome dialog



When you launch Prism, or use File..New to begin a new project, you'll see the Welcome dialog.

New table & graph

Most of the time, especially when new to Prism, you'll use one of the eight choices to create a new table 201 and graph. Within each of these tabs, you have the choice of beginning with a new empty data table or beginning with tutorial data (with instructions).

Existing file

Open a file

Click on a folder or file to open it. Or click on "Desktop and other folders" to browse all your files.

After you have used Prism a bit, you may see files listed under the heading Unsaved Files. How can you open a file that wasn't saved? When you exit Prism (as with any program), it asks you whether you want to save changes to every open file. If you click No, Prism still saves the file in a special location for four days, and shows it in the list of unsaved files.

LabArchives

LabArchives is an innovative web-based product that enables researchers to store, organize, and publish their research data. Far more than an "ELN" (Electronic Laboratory Notebook), LabArchives stores and catalogs all of your research for easy retrieval and publication. You can save files to LabArchives from Prism. And you can open Prism files saved on LabArchives from the Welcome dialog, without going to www.labarchives.com.

Clone a graph

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Cloning a graph is making a copy of it, along with the data table and any linked analyses. At the time you clone a graph, Prism will give you the option of deleting the data. Add your own data, and your done. From the Welcome dialog, you can clone from any file (project) that is open, from one you've used recently, or from projects you've save as examples.

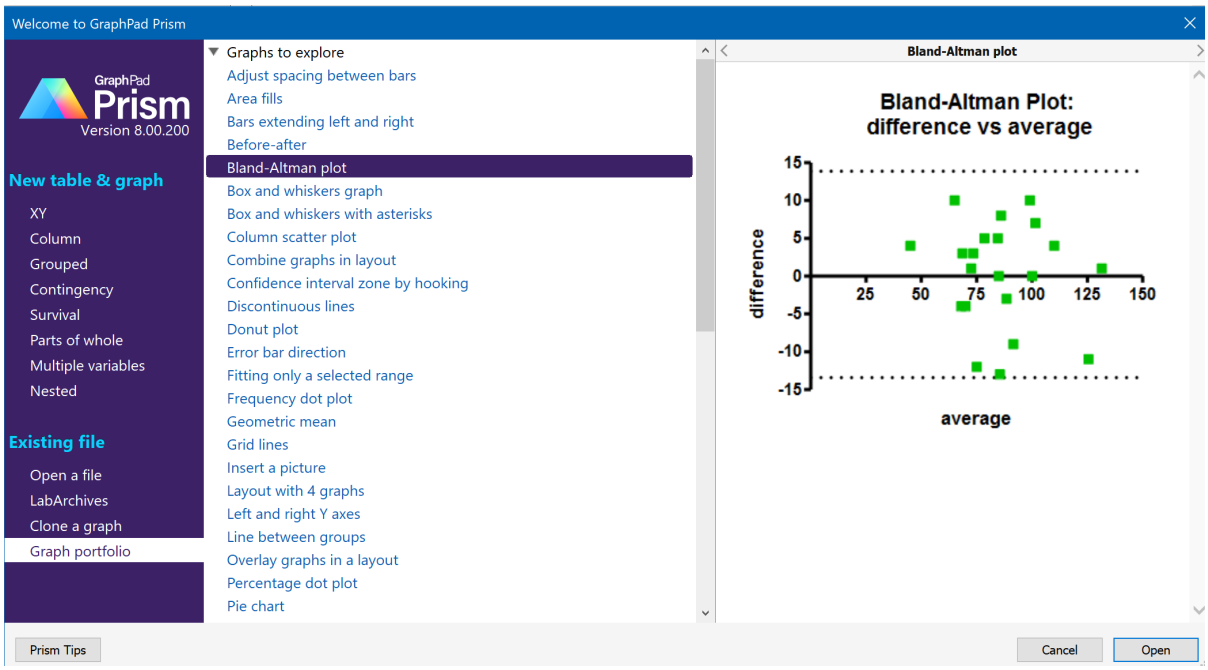
Portfolio

The portfolio 112 contains many Prism file, with with a polished graph, simple or complex. Explore these portfolio graphs to learn how to get started with Prism and to learn some of its advanced features. People who have already learned the basics of Prism will appreciate these portfolio files more than beginners.

.

5.4 Graph Portfolio

From the Welcome (File..New) dialog, click on the Graph Portfolio tab to browse dozens of polished graphs. Open any of them to see how they were made. Most come with explanations on floating notes.



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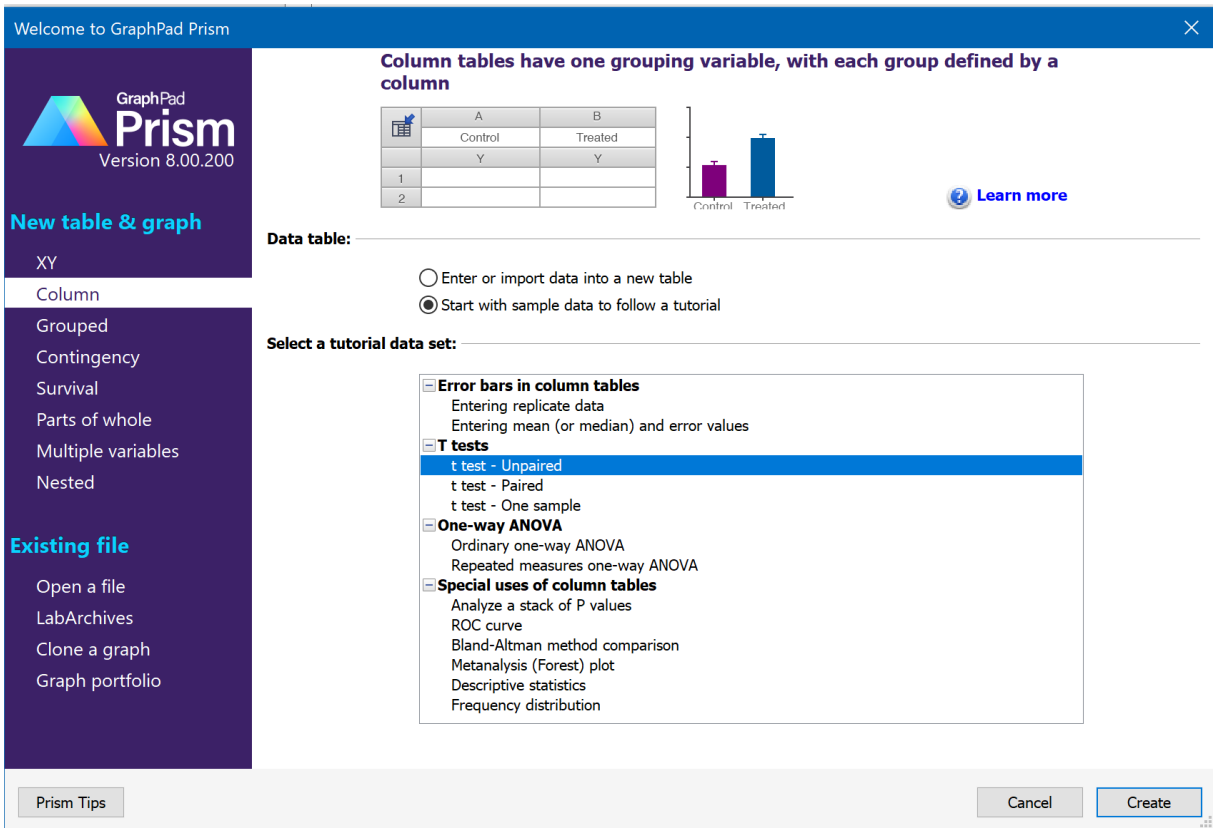
5.5 Tutorial Data Sets

When you choose to create a new data table from the Welcome (File..New) dialog, you can start with a blank table or with tutorial data. The tutorial data comes with explanations and is a great way to learn how to use Prism.

Note that these tutorial data sets exist only to help you learn Prism. Choose the t test tutorial data set if you want to learn how to do a t test with Prism. Don't choose it if you want to analyze your data with a t test.



5.6 The five sections of a Prism project

A Prism project can contain a lot more than a single graph or data table. A Prism project (file) has five sections. Each can contain up to 500 pages (also called sheets):

Data tables

Enter and organize your data for analyses or graphs. Learn more. 198

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	Group A	Group B	Group C
	Male	Female	Title
1	54	43	
2	23	34	
3	45	65	
4	54	77	
5	45	46	
6		65	
7			
8			
9			
10			
11			

- Info tables

  Keep a record of experimental details, or of constants you want to use in analyses. Learn more 185.

Constant	Value
Experiment Date	Apr-25-2006
Experiment ID	20045
Notebook ID	Gabe's lab 2007
Project	Conv Enz Inhibitor
Experimenter	Gabe
Protocol	See book CV-00305 pg 3

Notes

Enzyme activity measured in plasma fraction of blood withdrawn 2 minutes after injection of 10 µl inhibito fraction/90µl D5W, or vehicle only, in nerve-resect rat.

- Results

  These sheets show the results of your analyses. You can copy from here and paste parts of your results onto graphs. Learn more. 295

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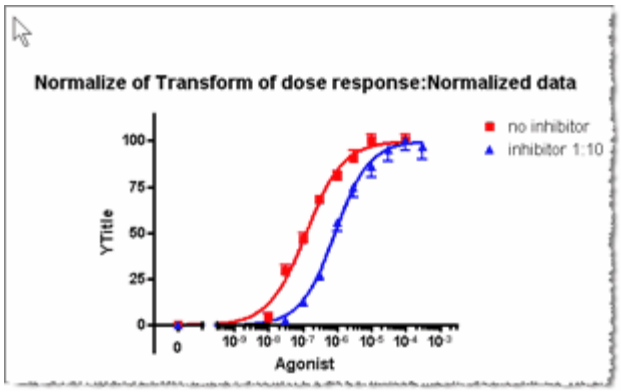
	Unpaired t test	
1	Table Analyzed	Unpaired t test dat
2		
3	Column B	Female
4	vs.	vs.
5	Column A	Male
6		
7	**Unpaired t test**	
8	P value	0.2613
9	P value summary	ns
10	Significantly different (P < 0.05)?	No
11	One- or two-tailed P value?	Two-tailed
12	t, df	t=1.199, df=9
13		
14	**How big is the difference?**	
15	Mean of column A	44.20
16	Mean of column B	55.00
17	Difference between means (B - A) ± SEM	10.80 ± 9.010
18	95% confidence interval	-9.583 to 31.18
19	R squared (eta squared)	0.1377
20		
21	**F test to compare variances**	
22	F, DFn, Dfd	1.680, 5, 4
23	P value	0.6354
24	P value summary	ns
25	Significantly different (P < 0.05)?	No
26		
27	**Data analyzed**	
28	Sample size, column A	5
29	Sample size, column B	6

Graphs

Once you enter your data in a data table, Prism automatically creates a graph. You can customize any part of a graph. Learn more. 391



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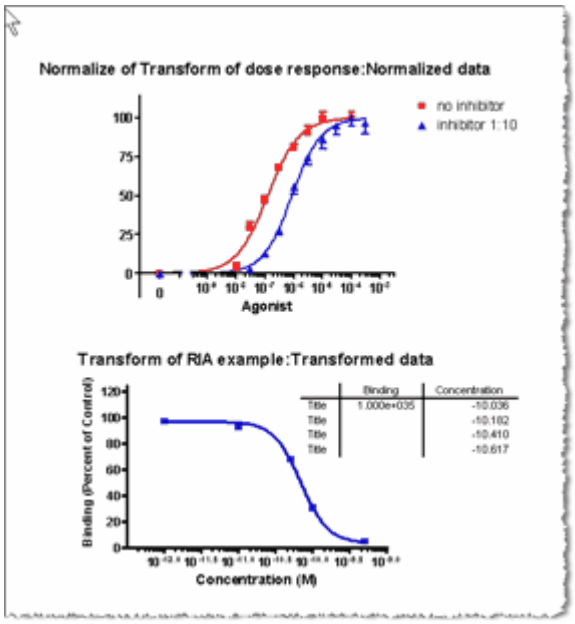
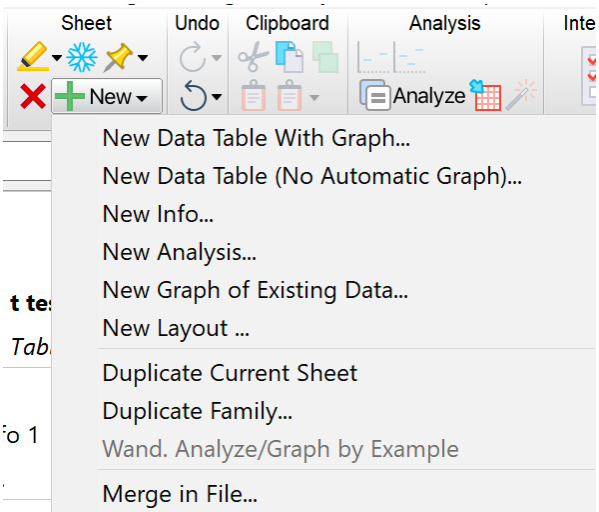
Layouts

Combine several graphs or other sheets in a layout for printing or publishing. You also can send layouts directly to PowerPoint and Word. Learn more. 544

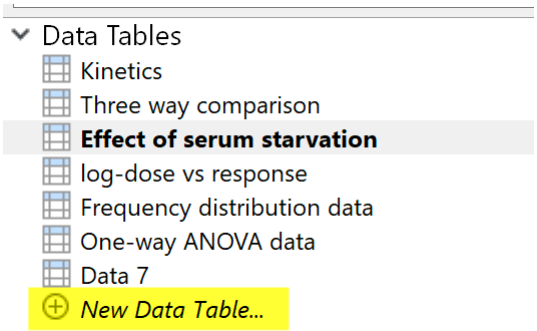


5.7 Adding new sheets to your project



Click the New button on the Sheet toolbar and choose what kind of sheet you want to create. The first choice is used the most. It adds a new empty data table and linked graph 222 to your project. You can also add a New Data Table (No Automatic Graph), a new Info sheet 185, a new graph of an existing data table 335, or a new layout 545. To be complete, this menu also lets you add a new analysis, but you'll find it easier to start at a data table or graph and click the Analyze button 296.

You can also add a new table, analysis, graph or layout by a link in the navigator.



You can also add to your project by duplicating a family of sheets 171 or by cloning a graph 173.

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5.8 Tips for using Prism

Expand all tips Collapse all tips

Getting started tips

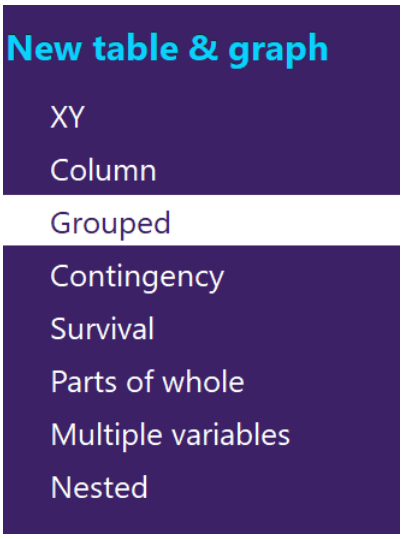
Before using Prism for the first time...

If you are new to Prism, start by reading this one page list 109 of essential concepts.

Also consider arranging on-site training 672.

Pay attention to the distinctions between the eight kinds of data tables

When you create a new data table, choose between a XY 206, Column 210, Grouped 212, Contingency 214, Survival 216, Parts of a Whole 218, Multiple Variables 219 and nested table. Understanding how these tables are used will make it much easier to use Prism effectively.



Learn about the various approaches to making bar graphs

Spending a few minutes reading about the various approaches to making bar graphs 224 will prevent some aggravation later. Bar graphs can be created from Colum, Grouped, XY or Contingency tables.

Recycle your work

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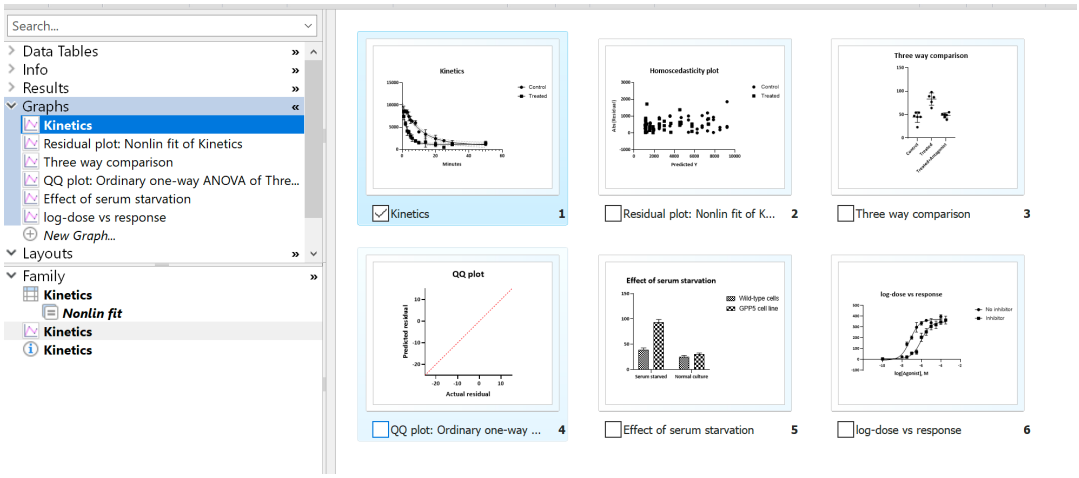
Once you've analyzed data and made some graphs with Prism, you'll probably want to do similar analyses and make similar graphs with new data. Don't start again from scratch. Prism offers four ways to recycle your work, without programming. You can duplicate a family 171, clone a graph 173, use the Wand to repeat analyses 175, or save and recycle templates 176.

Navigation tips

View all sheets in the gallery

Click on the Data Table, Info, Results, Graphs or Layouts folder name in the Navigator to open the Gallery. Or click the Gallery button on the bottom toolbar.

The gallery 182 shows all sheets in a section. Double click on the one you want to go to. Or select several sheets to work on at once 182.



Jump between related sheets using the Family navigator

The family folder at the bottom of the navigator lets you see all sheets linked to the current one. Results are nested under the table they analyze so you can see analysis chains.

Ping pong (flip back and forth) between two sheets

Click the ping-pong button in the bottom toolbar to go to the previously viewed sheet. Click again to return.

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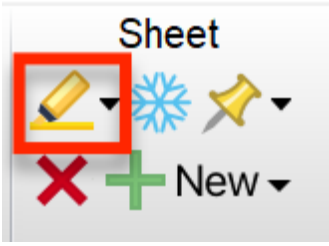
Highlight or annotate sheets you want to return to

Click the highlight 189 button, and the sheet name will appear highlighted in a chosen color in the navigator and gallery. You can later search 153 for highlighted sheets.



Annotate any sheet with a floating note 188, then find all annotated sheets by searching 153.

Search for sheets

If your project is large, use the search tool 195 above the navigator to find all sheets that include specified text. When you click to start entering the search term, new choices appear to restrict the search to sheets of a certain kind of highlighted with a certain color.

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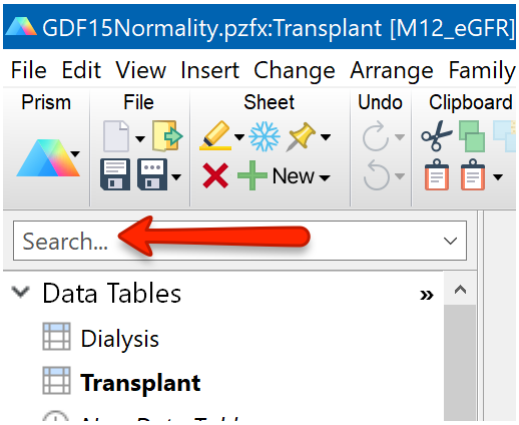

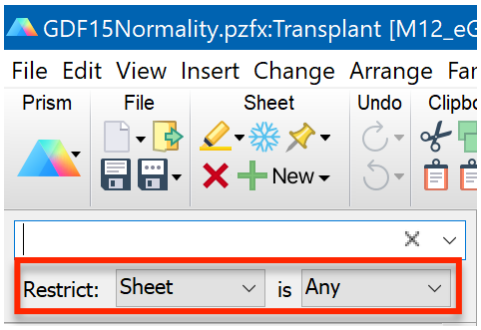

Graphing Tips

- Use the Format Graph and Format Axes dialogs

  Double-click on an axis to bring up the Forma Axis dialog. Double-click on the main part of the graph to bring up Format Graph.

- **Change the color (or size..) of just one symbol or bar**

  Right click 351 on any symbol or bar, and you can change its appearance, apart from other symbols or bars in the same data set. Or select a range of values in the data table, and change the appearance of all symbols or bars plotting those 351 data 351.

- **Use Prism Magic to make graphs consistent**

  Select one (or several graphs), click the Magic 347 (Make Graphs Consistent) button, choose an example graph, and all your graphs will be changed at once.

- **Change colors by picking a color scheme**

  Rather than change colors of every graph element separately, use color schemes 362. You can use ones we provide, or create your own.

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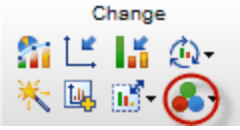

Prism can plot error bars directly from raw data

Prism can plot error bars directly from raw data. Prism lets you enter SD or SEM if you have calculated them elsewhere, but there is no need to do so. Enter your raw data, and let Prism do the rest. Prism offers analyses that perform row and column descriptive statistics, but these are only to help you understand the data. You do not need to run these analyses to plot error bars.

To add data to a graph, drag a table from the Navigator and drop onto the graph

After you drop the data or results table onto the graph, a dialog will pop up where you can choose which data sets to include and which axis to plot those data on (right or left).

Data analysis tips

Don't run the analysis again -- change the analysis choices

If you made a mistake, or want to try different analysis choices, you can always return to the analysis parameter dialogs. Don't repeat the analysis unless you want two copies of the results. To open the analysis parameters dialog, click the analysis parameters in the upper left corner of any results sheet or in the toolbar.

Use the 'Learn' and 'Analysis checklist' buttons

Click Learn from any Analyze dialog to learn more about the analysis. Our help goes beyond program help, and explains the principles behind the analysis.

Once you've finished any analysis, click the Analysis Checklist button in the toolbar to make sure you are interpreting the results correctly.

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Paste results onto your graph

Select any block of tabular results, copy to the clipboard, and paste onto any graph or layout. This will be a live link. If you change the data, or the analysis choices, the embedded results table 305 will update.

Create chains of analyses, without copying and pasting

Many analyses (i. e. Transform) create results tables that can be used as a data table. These results tables have green grids, unlike tables with red grids that contain tabulations of results that cannot be graphed. From any results table with a green grid, click Analyze to analyze the results. You can make the analysis chain as long as you want. For example, you could Transform, then Normalize, then fit with Nonlinear regression, then transform the residuals from the regression.

Exporting tips

Use the Send-to-Word and Send-to-PowerPoint buttons

Click one button 592 and you are done. No need to copy and paste, or export and import.

Experiment with copying graphs in EMF or WMF format (Windows only)

Prism Windows can copy graphs to the clipboard in one of three formats. You can tell Prism to only copy one format (File & Printer tab of the preferences dialog 191). If graphs pasted into other programs don't look right, try all these settings.

Choose export formats carefully

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Prism offers a variety of formats 576. When possible, choose formats that include information about vectors and fonts (WMF, EMF, EPS, PDF) over formats that only describe bitmaps (TIF, JPG, PNG).

Send your colleagues complete Prism files rather than exported images

Anyone can view the complete Prism file, including analysis choices, using the Prism Viewer for Windows, Mac or iPad.

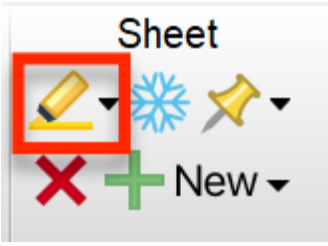
Organizing tips

Rename, reorder and delete sheets

You aren't stuck with the sheet names that Prism assigns, or their order. Rename or reorder 181 your data tables (and graphs...). When you rename data tables, linked analyses and graphs are automatically renamed. Delete sheets 181 you no longer need.

Highlight sheets you want to return to

You'll see the yellow highlighting 189 in both the navigator and gallery. You can choose different colors for different purposes.



Use floating notes to communicate with coworkers

Click the push-pin icon to add a color-coded floating note 188 to any sheet.

Record experimental details on info sheets

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Info sheets 185 contain both structured information (lot numbers, page numbers,....) and unstructured notes. Each info sheet can be linked to a particular data table.

Constant	Value	Notes
Experiment Date	Mar-4-2007	
Project	007	
Experimenter	Bond	
Protocol	Shaken, not stirred	

Don't make projects too small or too large

Some people make the mistake of starting a new project for every data table, not realizing that a Prism project (file) can have up to 500 data tables, analyses and graphs. You can keep an entire project in one file.

Don't define 'project' too broadly, because a huge project can be hard to navigate. You can always merge 164 projects later, or include 546 a graph from one project in a layout of another.

Common mistakes

Mistake: Repeating an analysis rather than fixing it.

If you want to change your mind about analysis choices, you can do so 302. You can change the parameters (options) for the analysis. Or you can change which data table and which data sets are analyzed. There is no need to start the analysis again, which leaves an obsolete copy of the results in your project.

Mistake: Duplicating a table in order to make a second graph of those values.

Prism automatically makes a graph of each data table. So when you want to make a second graph of that same data, people commonly copy the data and paste onto a new table which is automatically graphed. No need for that. You can make any number of graphs from the same table. Just click the New button, and then choose Graph of Existing Data.

Mistake: Repeatedly formatting a series of related graphs.

No need to change the fonts, colors, line thickness, etc. etc. for each graph in a series. Instead, format one graph, and use Magic 347 (Make

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Graphs Consistent 347) to instantly fix the others. Or clone the polished graph when you want to make a related graph.

Mistake: Making a project too large.

We call a Prism file a "project", but you can decide how large to make it. Huge files can be hard to navigate. So it often makes sense to keep files of reasonable size. You can always merge 164 projects later, or include 546 a graph from one project in a layout of another.

Mistake: Going through many steps to make the same graph from a new data set.

There is no need to repeat yourself. Once you have a graph you like, Prism offers several ways to make that graph again with different data. Start by learning to clone a graph 173.

Mistake: Not saving milestone backups while working on a large project.

When working on a large project, do more than backup the current version. What happens if you mistakenly delete key data? What happens if the file someone gets corrupted? Use Prism's Backup command 128 to save interim versions as you work. Prism Mac does this automatically, using the Versions feature of MacOS.

Expand all tips Collapse all tips

6 Differences between Windows and Mac versions of Prism

6.1 File compatibility between Windows and Mac

Files saved on one platform can be opened on the other. In almost all respects, this just works and you don't have to think about it. But there can be minor changes due to differences in fonts, so we suggest not switching platforms when you are in the final states of preparing a complicated figure.

Some Mac fonts families are not available on Windows, so those characters will appear as a rectangle. For example, the following fonts installed on Mac will not appear on Windows: cuneiform, linear, aegean, miao, inscriptional. Similarly, so Windows fonts are not available on Mac.

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6.2 Unique to Prism Windows

6.2.1 Features in Windows but not Mac

- Object linking and embedding 594. This means you can paste a Prism graph into another program and double-click to edit in Prism. We wish we could allow this to work on Prism Mac, but Apple and Microsoft simply do not provide the "hooks" Prism would need.

- Excel linking and embedding 270. This means you can paste Excel data into Prism, and double click to edit within Excel. We also wish this were possible with the Mac.

- Import and export EMF and WMF images. These formats are only used on Windows computers.

- Send to Word with a single click 592.

- High contrast printing, with no grays and no colors (choice on Preferences dialog).

- Visual Basic for Applications (VBA) commands 647 to launch Prism and start a script.

6.2.2 Working with multiple files in Prism Windows

Distinguish multiple sheets in one project file from multiple files

A Prism project can have multiple pages or sheets 146, divided into five sections 113. These are all saved in one Prism .PZF or .PZFX file. Of course, you can export individual data tables or graphs, but this is not the same as saving the entire project as one Prism file.

People new to Prism often make the mistake of thinking that each Prism file can only have one data table and one graph. Not so. Each file can contain up to 500 data tables, info sheets, analysis results, graphs and page layouts.

One window per file

Starting with Prism 8, each Prism window contains one Prism file. Prior versions used one master window that could hold multiple child windows, one for each file. This multiple document interface is no longer recommended by Microsoft, and Prism no longer supports it.

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Since there is one window per file, you can put different windows on different displays, and can size and position each as you see fit.

Closing a Prism file

There are two ways to close a Prism file.

- Click the red X at the upper right of the Prism window. This will close the file and also close the window. If you only have one Prism window open, this will quit Prism.

- Drop the File menu and choose Close. Or use the Control-W or Control-F4 shortcut. This will close the file, but leave the window open, ready to open or create another Prism file.

6.2.3 Automatic back up of Prism files

This page is for Windows only. Autobackup on Macs 134.

Automatic backups

Choose automatic backups on the File & Printer tab of the Preferences 191 dialog and Prism will automatically save your work. Choose to save based on a timer (every few minutes) and/or whenever you switch from one sheet to another. The backup files are also saved whenever you save your work, so the backup files can never be older than your project files.

When you quit Prism normally, the timed backup files are deleted. In case of computer disaster, the backup files will remain on your hard drive. When you restart Prism, these files will automatically load so you can continue your work. Note a potential problem: After a crash, the automatic backup system works fine if you launch Prism as an application. But if you double-click on the file you were working on, then you open that saved file, not the backup that Prism saved elsewhere.

If you need to find these files, which have the extension .PZB, their location depends on which operating system you use:

Windows XP	C:\Documents and Settings\[username]\Local Settings\Temp\

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Windows Vista, or Windows 7-10	C:\Users\[username]\AppData\Local\Temp\
Mac OS	~/Library/Application Support/GraphPad/Prism/8/Prism Backups

Manual backups of Prism files

Prism provides an unusual way to save backup copies of your projects. Click on the Save Special button in the File section of the Prism toolbar, and choose Save a Copy. Prism will save a copy of your project to the location and name you specify, perhaps to a network or CD drive.

Note the difference between Save As and Save a Copy. When you use the Save a Backup command, Prism doesn't rename the file you are working on -- it simply saves a copy of that project with a new name.

We recommend that you backup to the .PZFX format (rather than .PZF) because it provides a more secure backup. It is possible (with some difficulty) to extract your data from these files without Prism, even if the file is damaged or truncated.

Recovering files you forgot to save!

When you exit Prism Windows (as with any program), it asks you whether you want to save changes to every open file. Have you ever clicked No by accident and lost your work? Prism 6 saves the file anyway, in a special location, and keeps it for four days. You can open those "unsaved" files from the Welcome (File..New) dialog of Prism Windows. If you delete the file, Prism will automatically delete the backup file, and not offer to recover it.

If you share a computer with others and don't want your unsaved work to be recoverable, you can turn this feature off on the File & Printer tab of the Preferences dialog.

Manual backups of Prism data tables

You can backup individual data tables using the File Export command. You can export to plain text tables (delimited with tabs or commas) or to an XML format. We recommend using XML format, even though it is harder to view, because it contains more information. XML format

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includes details omitted from the plain text formats, including about subcolumns, excluded values, and floating notes.

6.3 Unique to Prism Mac

6.3.1 Features in Mac but not Windows

- Automatic saving. Prism Mac uses the OS X features Resume and Versions 135, which may seem strange at first.
- Spell checking of text anywhere in the project
- Quick Look lets you preview graphs within a Prism file while using Finder.
- Color eyedropper. While setting any color, click the magnifying glass tool, then click on any color on any window to select that color.
- Use an Automator action 642 to launch Prism and run a Prism Script;
- Choice of color model (RGB, CMYK, or Grayscale) when exporting in JPEG format.
- Tabbed windows 130 to put several Prism projects in one document window.

6.3.2 Working with multiple files in Prism Mac

Distinguish multiple sheets in one project file from multiple files

A Prism project can have multiple pages or sheets 146, divided into five sections 113. These are all saved in one Prism .PZF or .PZFX file. Of course, you can export individual data tables or graphs, but this is not the same as saving the entire project as one Prism file.

People new to Prism often make the mistake of thinking that each Prism file can only have one data table and one graph. Not so. Each file can contain up to 500 data tables, info sheets, analysis results, graphs and page layouts.

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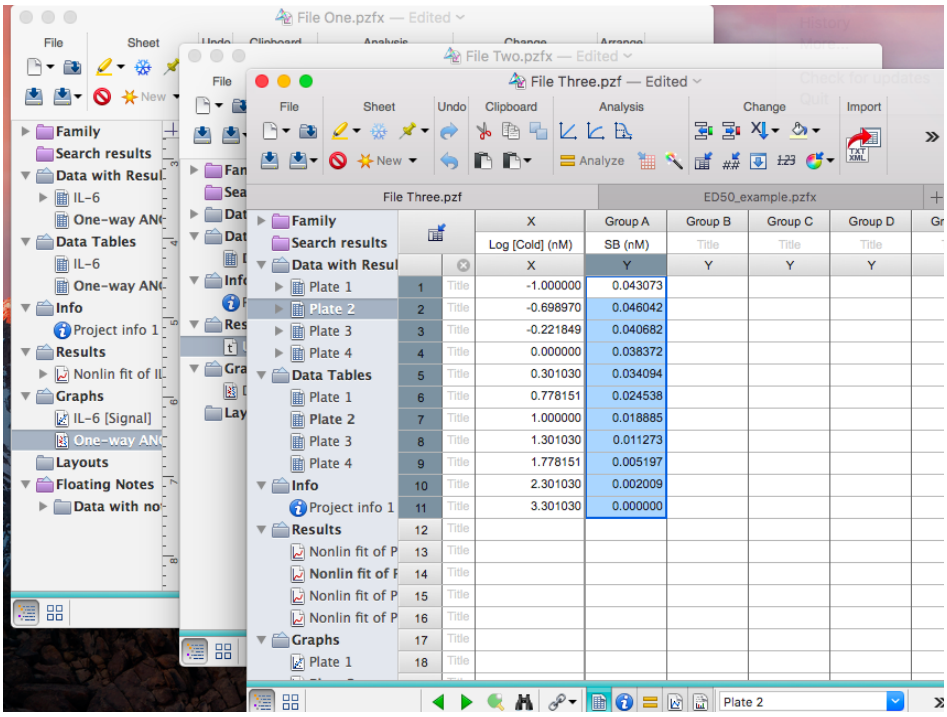
One window per file (usually)

Normally each Prism window contains one Prism file (but see below). If you have used Prism for Windows (prior to Prism 8) you used one master window that could hold multiple child windows, one for each file. This multiple document interface has never been supported on Macs.

When you create or open multiple files with Prism Mac, it usually looks like this. Each project file is in its own window with its own toolbar.



What are tabbed windows?

A new feature in MacOS Sierra lets you put several files into one window and navigate between them using tabs. This is a great way to work on multiple files at once, especially on a small screen. Apple calls this feature *Tabbed Windows*.

If you use MacOS Sierra or later, you work with multiple Prism files in one window. Drop the Window menu on any of the Prism files, and choose "Merge All Windows".

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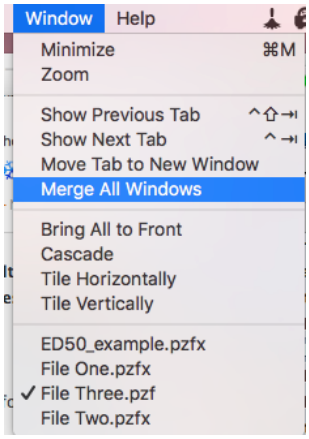
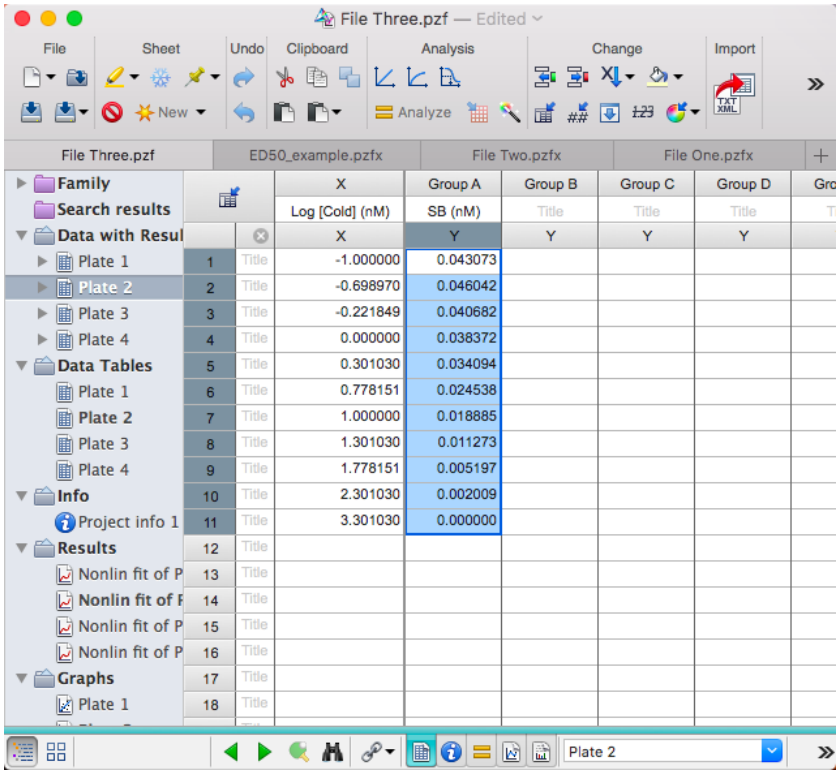


Now there is only one Prism Window, with a set of tabs just below the toolbar that let you choose which project file you are working on:



Putting multiple files in one tabbed window is simply a convenience to make it a bit easier to move between files. The files are still all distinct, saved in different names. Putting multiple files into one tabbed window does not merge the files.

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Working with tabbed windows

To create a new tab for a new (or existing) file, click the + button to the right of the file selection tabs which will create a new tab and bring up the Welcome dialog so you can choose a file to open or begin to create a new file.

There are three ways to move a file into its own window and away from the tabbed window: Control-click on the tab and choose Move Tab to New Window; grab the tab and drag it away from the joint window; or drop the Window menu and choose Move Tab to New Window.

A window that contains only one project file usually doesn't show the tab bar. To show it, drop the View menu (in Prism) and choose the first choice "Show Tab Bar". When you have two or more Prism windows showing the tab bar, you can drag tabs from one window to another (even on different displays).

Keyboard shortcut: Hold Control and click Tab to move to the next project file in the tabbed window. Hold shift and control and click tab to go to the prior project file.

Preference for newly created or opened Prism files

When you already have a Prism window open, what happens when you open another file or create a new file? It depends on a setting in the Dock tab of the system Preference dialog, "Prefer tabs when opening documents". (Note this setting is in the system preferences dialog, not in Prism's preference dialog.) There are three settings.

- Always. When you open or create a file, it will be added to a new tab on the open Prism window and will not create a new window.

- In full screen mode only. If you have maximized the Prism window to full screen, opening or creating files will add a new tab to the existing window. If you are not in full screen mode, new and opened files will be placed in new windows.

- Manually. New files (and newly opened files) always go into new windows unless you use the + button to the right of the last tab to create a new one.

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Closing a Prism file

There are two ways to close a Prism file.

- Click the red circle at the upper left of the Prism window. This will close the file and also close the window. If you only have one Prism window open, this will quit Prism. If that window has multiple files in tabs, all will close.

- Drop the File menu and choose Close. Or use the Command-W shortcut. This will close the file you are working on but not other open files. It will leave Prism running, ready to open or create another Prism file. when you drop its File menu.

6.3.3 Overview: Resume and Versions in Prism Mac

Versions and Autosave have been part of OS X since 2011, and Apple thinks these features are so intuitive they don't need explanation. For those who disagree, we created a lengthy explanation 135.

Here are the big ideas:

- As you work, your file is automatically saved. You don't have to think about saving. Close a project file when you are done working with it. Open it when you want to work on it again.

- When you quit Prism, it remembers the files that were open. When you next launch Prism, those files will open again. This means you won't see Prism's Welcome dialog unless you closed all open files before quitting.

- If you need to, you can revert a file back to how it was an hour (or a day...) ago.

- The File..Save command has a new purpose after its first use to specify a file name and location. After that, use the Save command to save a milestone you can revert to.

- The File..Save As command is gone, replaced with three new commands: Rename, Duplicate and Move. Whatever your goal with Save..As is probably done better with one of these three commands.

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- Two settings in the General tab of Systems preferences affect how your work flows: whether to keep changes when closing a document, and whether to open the documents you were working on when you start an application. These apply to all applications that use the new way of working, not just Prism. We suggest you keep both options checked.

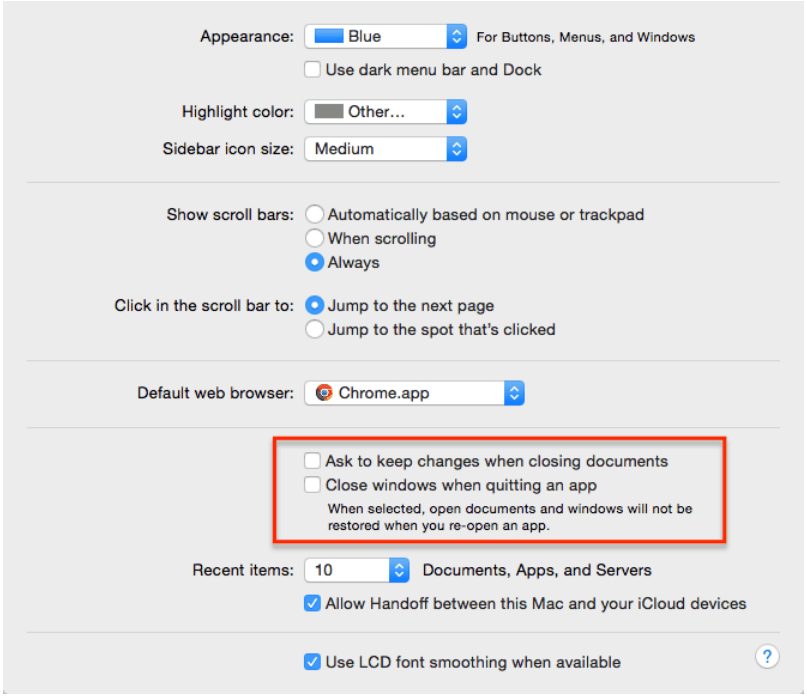
6.3.4 Details: Resume and Versions in Prism Mac

Note that this page only applies to Prism Mac, not Prism Windows.

Versions and Autosave have been part of OS X since 2011, and were introduced to GraphPad Prism in version 7. If you use iWork (Pages, Numbers and Keynote), you are already familiar with these features. Since we know that many Prism users will have not encountered this new way of working before, we detail how these features work below. But note that we simply implemented the framework that Apple created, so have no ability to fine-tune how it works.

Important settings in the General tab of System Preferences

Two setting in the General tab of System Preferences have a huge impact on how Prism acts when you close a file or exit Prism.



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By default, both are unchecked. Both options apply to all applications that use Autosave and Versions, not just Prism. Most of this page assumes that you have left both options unchecked (the default), and we urge you to use Prism for a while this way to get used to the new approach. What happens when you check these options is explained at the bottom of this page.

A new mindset

When working with previous versions of Prism, as with Microsoft Office and many other programs, you had to always remember that you were editing a transient document in computer memory. If your computer crashed (or lost power for a fraction of a second), your work was gone unless you had saved it. Prism had an automatic backup feature to recover your work when this happened. So you had to remember to frequently save work in progress. This made sense in the days of slow floppy disks, but those days are long gone.

Prism now conforms to the new paradigm that Apple created for working with files. There are three new big ideas:

- As you work, your file is automatically saved. You don't have to think about it. Close a project file when you are done working with it. Open it when you want to work on it again. You'll always be working on the latest version and don't have to think about saving.
- When you quit Prism, it remembers the files that were open. When you next launch Prism, those files will open again. This means you won't see Prism's Welcome dialog unless you closed all open files before quitting.
- If you need to, you can revert a file back to how it was an hour (or a day...) ago.
- Whenever you want, you can duplicate a file, and then edit each copy differently.

A new way to work

Once you get used to it, this is a much better way to work.

The Save command has a new purpose

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The File..Save command still exists, but its purpose has changed. When creating a new project, use this command to specify its name and location. After that, use this command when you have completed a chunk of work, and want to save a milestone you can revert to (see below).

There is also another use of the Save command. Prism let's you copy a graph from one project and place into a layout of another as a link. If you change the graph, the copy of the graph in the other graphs layout ought to update. But this only happens if you use the Save command to save the file with the graph. Otherwise the second project doesn't get the message that the linked graph has updated.

No need for a File..Save as command

The File.. Save As was always annoying because it rarely did exactly what you wanted. So Apple removed it and replaced it with three new commands on the File menu:

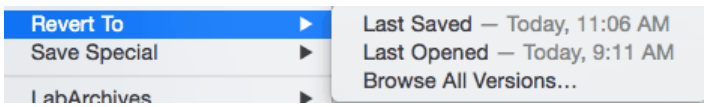
- File..Duplicate. Make a copy of the file (which you can name), and then edit the copy while leaving the original alone.
- File..Rename. Rename the file you are working on. You'll enter the new name at the very top of the Prism window.
- File..Move. Move the file you are working on to a different folder or drive.

If you really want to use the old File..Save As command, it is possible 142.

Reverting files

A version of your file is saved when you open a file, when you choose the save command, and occasionally while you work on it. This happens with most drives, but drives connected over a network using AFP, SMB, or NFS don't preserve previous versions of a document. MacOS will warn when you save to such a drive (volume).

The File.. Revert To command lets you revert your file back to how it was when you opened it, to how it was the last time you explicitly saved it, or to browse all versions to find the one you want to restore.



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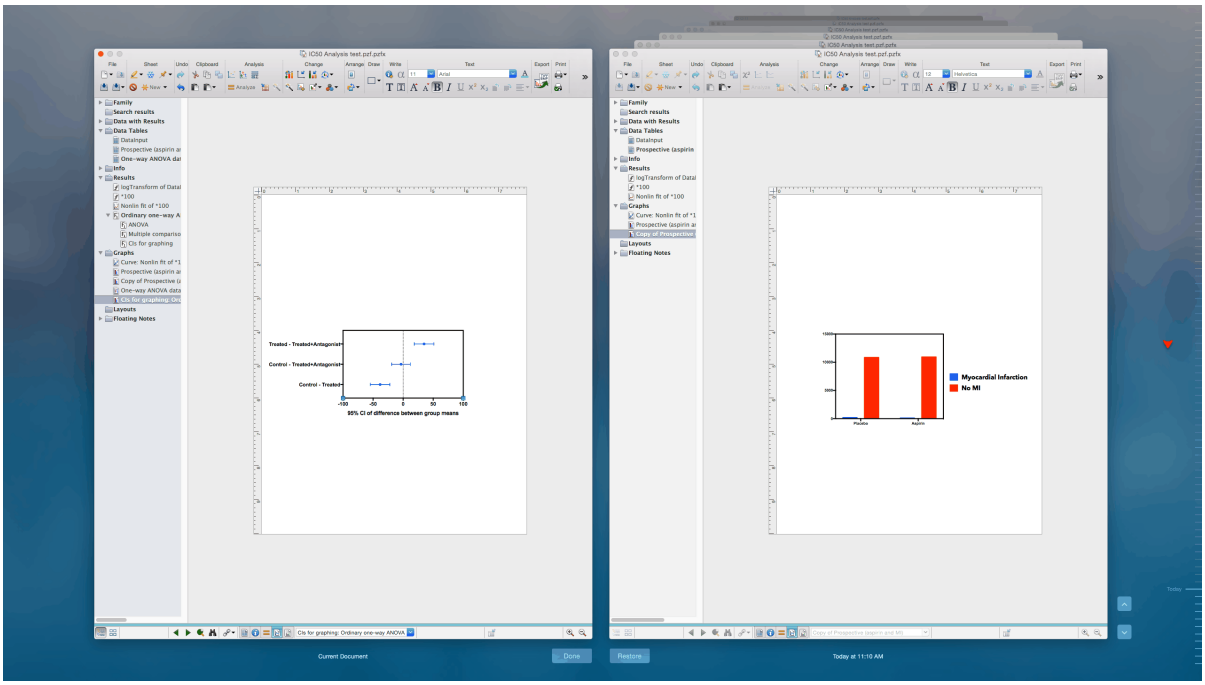
When you ask to browse all versions, the Revert screen fills your display.



The left side shows the current document.

The right side shows a stack of older versions.. Use the buttons near the bottom right to step through the versions. There is a bug (by Apple) so sometimes these buttons appear gray/unavailable. Click them anyway -- they work. If you have lots of saved versions, use the time line on the right side of the window to fast forward to the version you want.

Click on a version to temporarily open it and view all of its contents. If you don't want to revert to any older version, click Done to keep working with the most recent version. If you do find a version you want, click Revert to go back to that version. The current version won't be entirely deleted, and you can fast-forward back to it, in the version browser.

Notes on reverting files:

- You are only able to browse prior versions so long as you work on a single computer, as the information about prior versions is not saved in the file itself, but rather is saved in hidden files on your computer.

- To delete a version or all old versions: Select that version on the right side of the revert screen, move the cursor to the top of the screen to

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see a menu, drop the File menu, choose Revert to, and you'll see the new command "Delete this version". Hold Option and that command changes to "Delete old versions" to delete all versions (except the current one, of course).

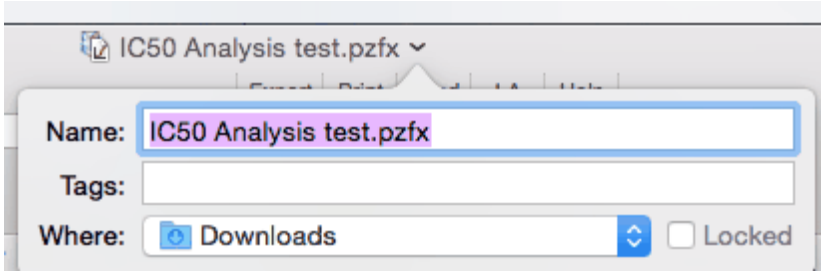
- While in the revert screen, you cannot switch to other applications. To leave the Revert screen you need to click Done (to make no changes) or Revert.

- To save an older version while also saving the current version: Click on the version you want, move the cursor to the top of the screen to see a menu, drop the File menu, and choose Restore a copy. If you have selected the current version (on the left), this command changes to Duplicate.

- Instead of reverting, you can select data or text (but not graphs or layouts) from an old version, copy to the clipboard, and then paste into the current version. In some situations, this is more useful than restoring an old version entirely.

Rename, tag and move from the top of the Prism Window

Hold the mouse cursor over the file name at the top of the Prism window, and you'll see a downward pointing arrow. Click that arrow, and you can rename the file, add tags, move it to a different folder, or lock it.



Notes:

- The full file name is shown, including the extension .pzf or .pzfx. You cannot change the extension from here. You'd need to use the File.. Save as command (see above; you need to hold down the Option key).

- Locking is not secure. There is no password, so anyone can unlock. Its purpose is to prevent accidental changes. No, it is not very useful!

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- When you click in the Tags field, a list of current tags (including color codes) will drop down. You can also tag files in Finder, and search there for files by tags. A file can have more than one tag. You can also enter a new tag. Tagging is an OS X feature, not a GraphPad feature.

- The list of locations is limited to top-level folders, or folders you have used recently. The last entry in the file list is Other. Double click "Other" to open a Finder-like window that lets you choose any drive or folder.

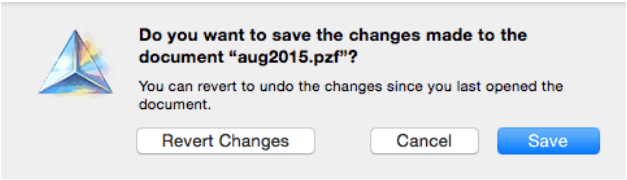
Settings in the System Preference dialog

As mentioned at the top of this page (with screen shot), two settings in the General tab of the System Preferences dialog affect how Prism saves files.

Ask to keep changes when closing documents

With the new way of working, Prism doesn't prompt you when you close a named project with unsaved changes because the changes are automatically saved. When you open that file again, you'll see the latest version. If the project is new, and not yet named, Prism will prompt you to name it or delete it when you close its window.

If you check the setting in General tab of System Preferences, "Ask to keep changes when closing documents", Prism asks you what to do when you close a document with unsaved changes:



If you click Save, Prism saves your latest work before it closes the document.

If you click Revert Changes, Prism reverts any automatic saves so the document that gets saved is the same as it was the last time you explicitly saved it.

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Since this option is in system preferences, it applies to all applications that use the modern way of working, not just to Prism.

It reminds you of the old way of working, but it doesn't reset things all the way back. We recommend not using this option, as it isn't really helpful.

Close windows when quitting an app

With the new way of working, when you launch Prism the projects that were open when you exited Prism open automatically. You won't see the Welcome dialog if any project windows were open when you exited Prism. The idea is that you open a document when you want to work on it, and close it when you are done (for now). Launching and quitting Prism has nothing to do with with when project files are open.

If you check the setting in General tab of System Preferences (see top of this page) "Close windows when quitting an app", then Prism will save and close all the projects when you quit. If a project file is not yet named, Prism will ask you to name it. When you next open Prism, you'll see the Welcome dialog and no projects will open automatically.

This seems like a useful personal preference. Check this option if you want to start fresh with the Welcome dialog each time you launch Prism. Don't check it if you like the idea of that when you launch Prism, it opens the files you left open the last time you used Prism.

Since this option is in system preferences, it applies to all applications that use the modern way of working, not just to Prism.

Automatic backup

Prism has had automatic backup since version 3, but now Prism uses the built in automatic backup feature provided by Apple, instead of using our homegrown method. In the File tab of Preferences, choose how often you want to save automatic backups and whether you also want a backup made whenever you view a different sheet. We suggest saving backups every few minutes and whenever you view a new sheet.

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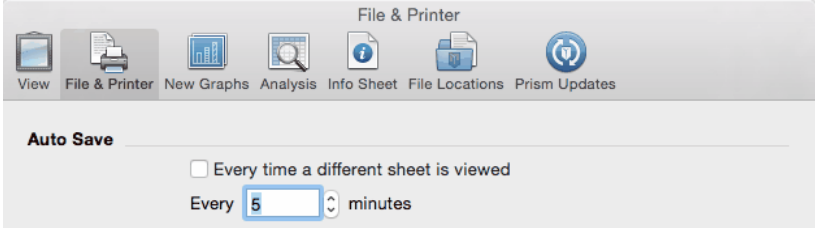

The purpose of automatic backups is to restore your work if your computer (or Prism) freezes or crashes, so you want frequent backups. These automatic backups do not all appear in the Revert screen (which would be overwhelming).

Turning off autosave

Autosave is part of macOS ,which does not make it easy to turn off. But these links tell you how to do so. GraphPad has not tried, and does not support, this method but simply provides the links:

https://www.makeuseof.com/tag/guide-mac-file-versioning/

and

https://apple.stackexchange.com/questions/27544/how-to-completely-disable-auto-save-and-versions-in-mac-os-x-lion/52390#52390

What if you don't want edits to be saved?

In some cases, you want a file to be a template. Edits are not saved, or at least not saved on top of the file. You can save a template 176 from Prism and it will appear on the Welcome dialog. Note that you must be on a data table for the Save Template command to be available. You can also simply change the name of any file so it has the .pzt extension (not .pzf or .pzfx). When Prism opens a file with a .pzt extension, it forgets the original name and assigns a generic file name. When you edit the file, changes are saved to "untitled" not to the original file.

6.3.5 File..Save As command in Mac

Note that this page only applies to Prism Mac, not Prism Windows.

Why there is no Save As command

Prism Mac uses the new File menu introduced by Apple. Details 135. It has no File..Save As command visible. It isn't needed because the new

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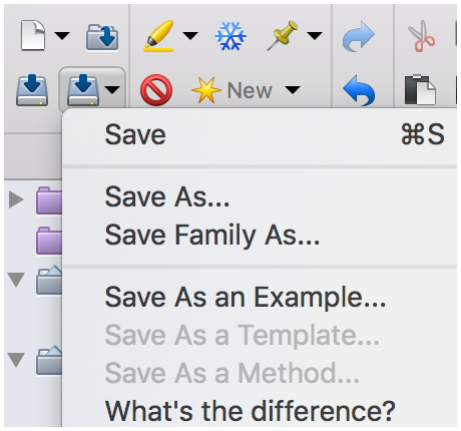
commands, Duplicate, Rename, Move and Save Copy do what most people use Save as for. But you can expose the Save As command if you really want to.

How to get the command if you really really want it

If you really want Save As, you can get it in two ways:

- Hold the Option key, and drop the File menu. Now the "Duplicate" command is gone, replaced with "Save As..."
- Press the Save menu button in the toolbar. You'll see "Save As" on that menu.



What the Save..As command does

The whole idea of the new way of working is that there is only one document. In the old way of working, there was one copy on disk and one transient copy in working memory (RAM). If you didn't save your work (on purpose or by accident) all your work was lost back to the last save. If you used File..Save as, you'd save the current RAM version of the file in the new name, while the older file continues to exist. With the new way of work, there only is one project file.

The Save As command makes a duplicate of the file with the name you entered. The original file still exists and is saved with has all the edits up to the time of Save..As. Immediately after using Save As, the two files are identical. You can then roll one of the copies back to how it looked before the edits.

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Why you don't need to use the Save..As command

- If you want to rename, use File..Rename.
- If you want to put the file in a different folder or drive, use File..Move to.
- If you want to clone your file, so one copy has the older information and the other has the edits, use File..Duplicate. That will create two copies of the file. You can close one (to keep it as is) and edit the other.
- If you want to save a copy of the current file as a milestone or backup, use File.. Save a Copy (in the Save Special menu).
- What if you have made many edits and want to save these with a new name without changing the saved version? You can't do exactly that because there is no distinction between the working (ram) version and the saved version. But you can accomplish the same goal. Use File..Duplicate. Then use File..Revert to bring one of the files back to how it was. Then close that file if you are done with it, and work on the other copy with all your edits. Note that File..Revert only works so long as you are on the same computer that did the edits. The information needed to revert is saved in hidden files on that computer's drive, not within the Prism file.

How is Save As different than Duplicate and Save Copy?

The commands are very similar. After invoking any of the three commands, you'll have two identical files with different names.

- After File..Duplicate, both files are open.
- After File..Save As, the original file has been closed and only the newly named copy is open.
- After File..Save Copy, you continue working on the same file with the old name, but a milestone backup was saved with the name and location you entered.

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The one use of Save As that has no alternative

There is one purpose of Save As that is not available with the other commands. If you have saved the file in .pzf format and want to switch to .pzfx. Or the other way around. The only way to change file extension is to use File..Save As.

7 Getting around in Prism

Prism is easy to use. Use the Navigator tree to move between parts of a project, and toolbars to perform tasks.

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7.1 Navigator -- See all sheets in your project

The navigator

The Prism Navigator tree on the left side of the Prism screen shows the contents of your Prism file.

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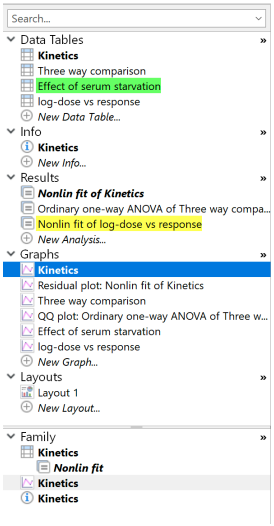

- The five folders (Data tables, Info Sheets, Analysis Results, Graphs, and Layouts) define the five sections of a Prism project. You can not create more folders, and cannot create subfolders.
- Each folder (section) can contain up to 500 sheets (pages).
- Click on one of the folder (section) names to view thumbnails of all the pages in that section in a gallery 148.
- Click on any sheet name to go to (view) that sheet.
- Sheets can be highlighted 189 in various colors. To do this, use the toolbar button or right click.
- Results and graph sheet names in italics are frozen 185 so won't update when the data are edited or replaced.
- At the bottom of the list of sheets in each folder is a link for a new sheet of that type. Click to create a new table, graph, etc.
- Above the navigator is a search 153 box.
- The current sheet (the one you are looking at) is highlighted. All sheets linked to that sheet (the family) are shown in bold.
- Right click on a sheet name to rename, highlight, freeze, duplicate, etc.
- Analysis sheets can spread the results over several analysis tabs 298.

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The Family folder

At the bottom of the navigator is a Family folder. It shows sheets related to the current one. Results are indented under the data they analyze. Analysis chains (first transform, then normalize, then fit a curve..) are shown by further indentations.

In some cases, sheets in different sections can have the same names. Distinguish them by the icons in front of each name which indicates the folder (section) it belongs to.

Hiding the navigator

If you need more room to work, click the button in the lower left corner of the Prism window to hide the Navigator. Click it again to bring the Navigator back.

See also:

Tips for navigating large project 195

Analysis tabs 298

7.2 Gallery - View all the sheets of one type

Viewing the gallery

The gallery shows you thumbnails (small images) of all the sheets in a section at once.

To view the gallery, click on the folder name in the navigator. Click on "Family, Data Table", "Info", "Results", "Graphs" or "Layouts".

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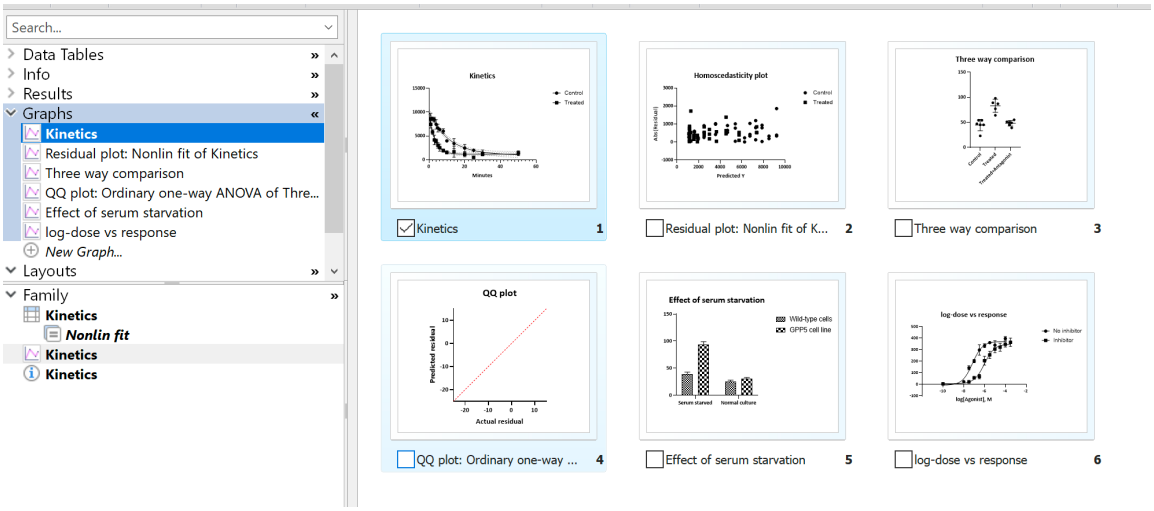

Another way to view the Gallery is to click its button on bottom toolbar.

Notes:

- Don't confuse the *Gallery*, which shows you all the sheets in your project, with the *Portfolio* which shows you a set of polished graphs you can use as examples. View the Portfolio from the Welcome (File..New) dialog.
- From the gallery, double-click on any thumbnail to leave the gallery and go to that sheet. This is the main purpose of the gallery -- to help you quickly find a particular sheet and go to it. Alternatively, you can leave the gallery by clicking on the gallery button in the lower toolbar shown above.
- Use the zoom buttons 155 at the bottom right of the Prism window to make the thumbnails larger or smaller.

Reordering the sheets

Drag and drop sheets to change their order. You can also do this in the navigator, but it is easier in the gallery.

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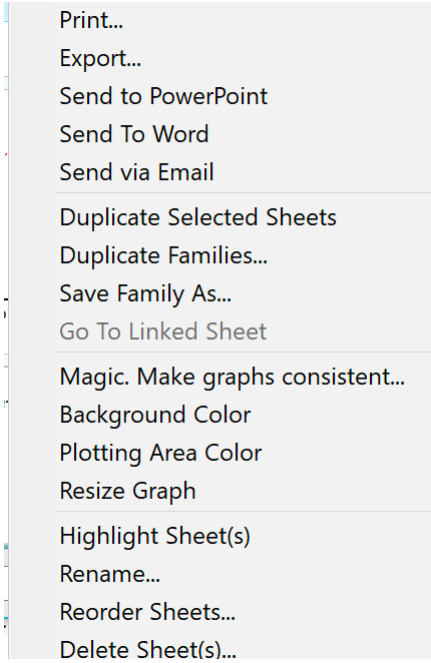
Working with multiple sheets

Click on option boxes in front of the sheet names to select multiple sheets. Once you've selected a set of sheets, right click to see all the commands you can apply to a set of selected sheets. Details 182.



7.3 Working with families of sheets

What is a family?

Prism remembers the links between data tables, info sheets, analyses, graphs and layouts. Replace or edit the data, and linked analyses and graphs will update. We call the current sheet with all linked sheets, a *family of sheets*.

Prism automatically determines which sheets are in a family. You cannot assign sheets to a particular family.

Viewing a family of sheets in the navigator

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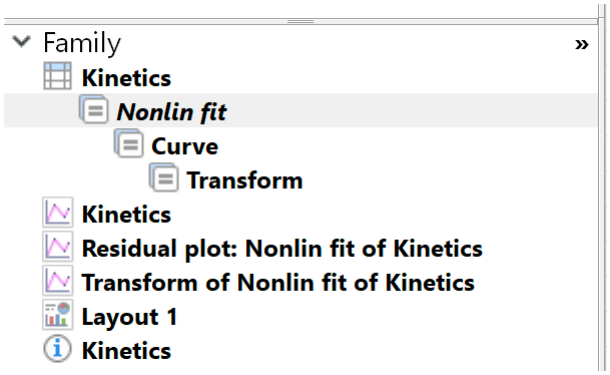
The navigator 146 shows you which sheets are linked to the current sheet. Their names are bold. If you have a large project, you may have to scroll to see all the linked sheets. Prism, therefore, lets you see them all at once.

Below the main navigator is the family navigator, a panel that shows sheets in the current family. This makes it easy to move among sheets in the family without having to scroll the navigator. You can drag this panel larger or smaller to meet your needs. Analyses are indented under the table they analyze so you can see analysis chains.



The family folder shows the family of the last sheet selected in the main navigator. If you then move from sheet to sheet in the family navigator, the definition of family will not update (until you click on a sheet name in the main navigator).

The Family menu

From anywhere in the program, drop the Family menu to see all the commands that work with the entire family of sheets related to the sheet you are now looking at. You get the same menu by right clicking on the word Family at the top of the Family navigator.

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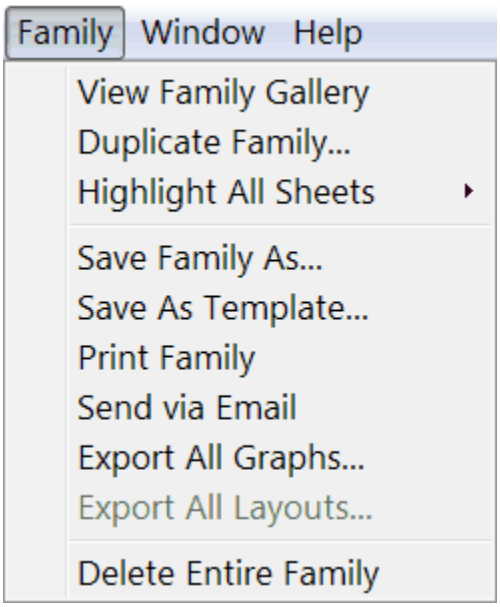

The details of how a family is defined

A family is the sheet you are looking at and all sheets directly related to that sheet. So if you are looking at a graph, the family includes the data table(s) plotted on that graph, any analyses included on that graph as curves or embedded results tables, and any layout(s) that include that graph.

Possible ambiguities:

- A graph can contain data from two more more data tables. If you start from the graph (and save or duplicate its family), both (all) those tables are part of the family. If you start from only one of those tables, the other table(s) are not part of the family.

- A layout can contain many graphs. If you start at the layout, the family contains all those graphs and all the data and results on those graphs. If you start from a data table, the family includes the layout, but not the other graphs (and related sheets) that are also on that layout.

- If you start from a data table, all analyses are part of the family. But if you go to a graph that includes that table, only analyses plotted on that graph (directly, by pasting a table, or by using analysis constants) are part of the family. Other analyses that are not actually on that graph are not part of the family defined when you start on a graph.

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- Info sheets can either be declared to be linked to a particular data table or to be global to the entire project. Prism includes an info table when you first create a new project file, and this info table belongs to the project and is not linked to the first data table. To choose, go to the table, drop the Change menu and choose "Link to data table". If an info table is linked to a data table, then it is part of any family that includes that table. If the info table is not linked to a particular data table, then it will not be part of any sheet's family -- with one exception. The exception is that when the project contains only a single info table, and all the other sheets in that project are linked to be part of a single family, then that info table is defined to be part of that family too.

- Don't confuse two uses of the word *family*. The term is also used when Prism does multiple comparisons after one- or two-way ANOVA. The multiple comparisons calculations are done so the probability alpha applies to the entire family of comparisons. This use of the word family in multiple comparisons has nothing to do with a family of sheets.

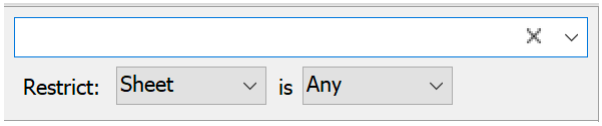
7.4 Searching for sheets in a large project

If your project is large, it can be helpful to search for the sheet(s) you want to work on.

At the top of the Navigator is a search box.

1. Click in the search box at the top of the Navigator.

2. Note that a new Restrict Row opens up.



3. Enter the term you wish to search for (or leave blank). Or click the downward arrow to the right of the search box to choose a search term you used recently. Optionally restrict the search to a certain kind of sheet (maybe only graphs), or to sheet with notes (perhaps of a

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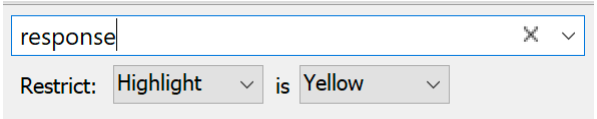
specified color) or sheets that are highlighted (perhaps with a specified color).



4. A list of the hits will appear in the navigator. The main part of the Prism window will show thumbnails of all the sheets.

5. Go from hit to hit to find what you need. Note that the Navigator continues to show only search results.

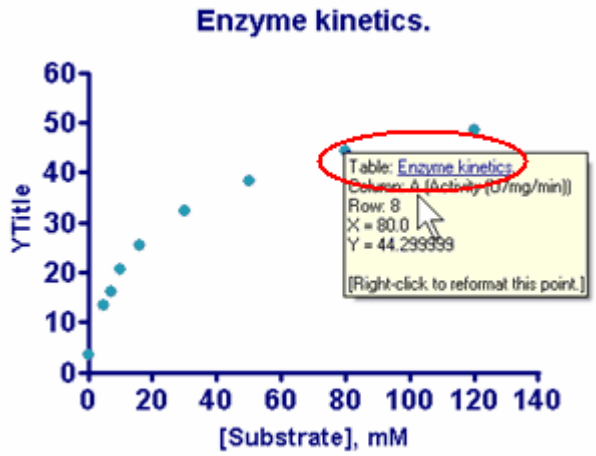
6. If needed modify the search term or restrictions.

7. When you are done searching, click the X at the top right of the search box to go back to seeing the entire navigator.

7.5 Graph and layout tool tips

Some of the tool tips in Prism do more than provide information. They also provide links to take you to other parts of the project.

Hover your mouse over a symbol on a graph to see the value, and location of the data point. Click on the name of the data (or results) table to go right to the correct spot on the data table.



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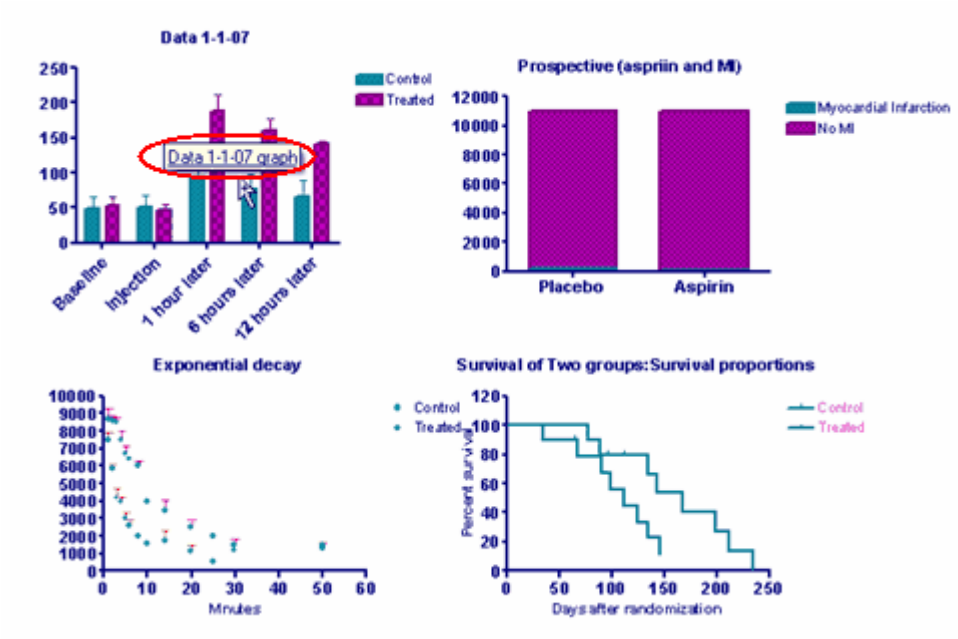
Hover your mouse over any graph on a Layout. A tool tip will appear with a link to the graph. Click on the link to go to the graph.



7.6 Changing the zoom

Zoom buttons

Use the Zoom buttons located on the lower right side of the Prism window to enlarge or shrink the view of the current sheet. You can also use the Zoom tools to make thumbnails in the Gallery 182 larger or smaller.

On graph and layout sheets, Zooming lets you see more or less of the sheet, but doesn't change the size of the graph or layout when printed. Click here to find out how to actually resize graphs 353 and layouts.

On data tables and analysis results sheets, the Zoom buttons not only change what you see, but they also actually change the size of the font

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Prism uses when you print. If you want to get more of your data table on a printed page, Zoom Out to make the font smaller.

Keyboard shortcuts

Shortcut: Hold the Ctrl key and press M to zoom larger or J to zoom smaller.

Mac gestures

Starting with release 6.0c (and if you use Lion or later), you can zoom Prism Mac by pinching with two fingers, but only if that gesture is turned on in the Trackpad control panel. You can also smart zoom by double tapping with two fingers. Depending on where you tap, that will zoom you in to see the entire page, the graph plus all other objects on the page, or just the graph.

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7.7 What if the toolbar or navigator is missing?

It is possible to use Prism without the Toolbar (top) and Navigator (left), and this can be useful on computers with tiny screens. But it is easier to learn Prism with both the Toolbar and Navigator showing. If someone else using the computer has turned off either, it is easy to bring it back:

- If the toolbar is not showing on your computer, drop the View menu and choose Main Toolbar.
- If the Navigator is not showing on your computer, drop the View menu and choose Navigator.
- If the bottom toolbar is missing, choose Bottom Toolbar on the View menu.

7.8 Tips for working in a small window

Working on a small screen can be difficult. To free up space to have more working space:

- With Prism Mac, you can click the green circle the top left of the toolbar to run full screen. When you use the View menu to view or hide the top toolbar, the navigator or the bottom toolbar, those choices will apply only to the full screen view. You can make different choices for when the Prism window does not fill the screen.
- Hide the Prism Navigator tree. To hide the navigator, use a command in the View menu or the leftmost button in the bottom toolbar.

- Hide the main (top) toolbar, and use the menu commands instead. To hide the toolbar, use a command in the View menu.
- You can also hide the bottom toolbar, but we suggest you don't. If you hide the navigator, you'll want to use the bottom toolbar to navigate from sheet to sheet and section to section.

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- With MacOS Sierra and later, you can put multiple Prism files into a single tabbed window 130.

8 Prism files

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A Prism project file (or PZF file) contains all the pieces of a project.

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8.1 Difference between Windows and Mac

Prism Windows works as you expect. You work on a temporary copy of the program in transient computer memory (RAM) until you save.

Prism Mac works differently. You don't ever need to use the Save command, as all changes are saved automatically. Read this overview 134, these details 135, and this explanation about what happened to the File Save 142 command.

8.2 PZF vs. PZFX files

Two formats

When you save a Prism file, you save the entire project into one file. You have a choice of two file formats:

- PZF format: This is a binary format that can be opened by Prism 4 or later, but not by other applications.

- PZFX format: This is a format that can be opened only by Prism 5 or later. The first part of the file contains all the data tables and info sheets in a plain-text XML format that can be viewed by other programs. After that comes information about results, graphs and layouts in a format that is incomprehensible to any program but Prism.

Advantages of PZFX compared to PZF

- The PZFX format is a bit more secure for long-term backing up. Even without access to Prism, the data in the file are in plain text that can readily be viewed.

- Files saved in PZFX format tend to be much smaller (about 10% the size) than the same file saved as PZF. We recommend that you use PZFX files routinely. Even though PZFX files are almost always smaller, they may be faster or slower than PZF files to save and open, depending on how large your data tables are and whether you included pictures in your graphs or layouts.

- The data (and info and scripts) are in a plain text format at the beginning of the PZFX file. It is possible to create a program that swaps

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out the saved data with new data. Open that altered file, and the new data will instantly be analyzed and graphed.

Disadvantages of PZFX compared to PZF

- Prism 5 was the first version that understand the PZFX format, so these files cannot be opened by Prism 4.
- Avoid the .PZFX format if you plan to post the file on a web site. Web browsers sometimes detect the XML format, and try to open the file with some program that understands XML rather than opening with Prism. In contrast, .PZF files generally just open in Prism, as they should.
- The PZFX format never contains analysis results, so Prism needs to recompute the results when it opens the file (or when you view those results pages or graphs that depend on them). If your analyses are very slow to recalculate, choose the PZF format with the Compact option turned off (see below). These files will contain analysis results, so Prism will not need to recalculate anything when you open the file.
- With large files, it takes about ten times longer to save or open a PZFX file than a PZF file. This is because the information about graphs and layouts is compressed in PZFX files, and compressing/decompressing can be slow.

Compact PZF format

Prism has an option to save PZF files in compact format. All the compact format does is leave out analysis results. Files with lots of complicated analyses will be smaller if saved in compact form, but all those analyses will need to be recomputed when the file is opened, which can take time. Choose to use, or not use, the compact format in the File tab of Preferences. PZFX files are always saved in the compact format.

Zipping the file with standard zipping software can do a much better job of compression. To really make a PZF file as small as possible, save it compact and then zip it.

Check the box in the Preferences 191 menu if you want to save in compact format as a default.

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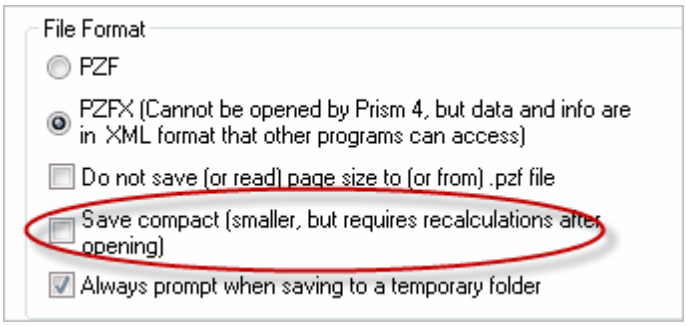

What if you have both a .pzf and .pzfx file with the same name?

Prism opens the file you ask it to open. It won't even "notice" that there is another Prism file with the same name (except extension). It won't coordinate the two files. We strongly suggest not keeping two files with the same name (but one .pzf and the other .pzfx) as it is too easy to get mixed up and lose work.

8.3 File compatibility between Prism versions

Cross platform (win/mac) compatibility

The Windows and Mac versions of Prism use the same file format, and you can go back and forth between Prism 8 Win and Mac without any special conversion.

Issues

- With older versions, there is one problem. If you pasted a WMF or EMF image (from another program) onto a Prism graph or layout using Prism Windows version 6 or earlier, that object will be replaced by a red object when you open the file with Prism Mac.

- If you use any of these nonstandard fonts (and perhaps others) with Prism 8 Mac, the symbol will appear as a box when you open the file in Prism 8 Windows: Cuneiform, Linear, Aegean, Miao, and Inscriptional.

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Upward compatibility

Prism 8 can open all PZF and PXFX files created by Prism versions 4-7, and can even open .PZM files created by Prism versions 1 to 3.

Downward compatibility

Overview

We have done extensive testing to make sure that Prism 7 can open Prism 8 files. When Prism 7 lacks a Prism 8 feature, the result is sensible. We have not extensively tested opening Prism 8 files in Prism 6 and earlier. It will probably work ok for many files, but this is not something we have tested.

But note there are likely to be changes when you open a file with an earlier version. Going back and forth between two versions is likely to be annoying.

The location of analysis results on analysis tables may change between versions

When you open a Prism file on a version different than the version it was created on, results also may appear on different rows of the results tables. This means that results tables embedded on graphs may no longer show the results you care about, and scripts may export the wrong values. You may have to do a bit of clean up to make the files work as intended.

Compatibility of Prism objects saved within other documents

On Windows (but not Mac), when you paste a Prism graph or layout within Word or PowerPoint (or some other programs), you can paste just a picture, paste a link, or embed a Prism object. If you paste a link or embed an object 594, you can then double click on that image to edit within Prism. This works only if the correct version of Prism (or the GraphPad Prism Viewer) is installed or a newer one is installed on your computer.

Special characters may change to question marks

Prism 8 introduces use of Unicode to encode all characters. This is how almost all programs work now.

When you open a file created with Prism 8 in an earlier version of Prism some characters will still appear fine (Greek..). But others will show as a

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question mark in the earlier version. Three notes to help ensure that most characters appear fine:

- To properly open p8 file with Unicode symbols in Prism 7, make sure you chose the appropriate locale for Prism 7. Other words, if user enters Japanese and saves file in Prism 8, then to properly open this file in Prism 7, user needs to make sure that Japanese locate is set in the system.

- Make sure that you have updated Prism 7 to the last release, which does a better job with character conversion than did earlier releases. Use Help..Check for updates.

- In Prism 7 and older, symbols that don't have an ANSII equivalent will show as "?" no matter which locale is set.

8.4 Merging and splitting projects

Merging

Prism offers three approaches to merging two Prism projects.

- To merge an entire Prism project into another: Drop the File menu and choose Merge. Pick a file (which must not be open). That's it. All sheets from that file will be appended to your current project. Prism places an asterisk (*) in front of the name of each merged sheet.

- To merge just one graph and its related sheets into another Prism project starting from the project with the graph: Copy a graph from one Prism project. Go to a layout page in another project. Then paste. Prism will ask if you want to paste an unlinked picture, paste a linked picture (linked to file you pasted from), or merge the graph and its family into the new file.

- To merge just one graph and its related sheets into another Prism project starting from the project you want to merge into: Go to a layout page. Double click on a graph placeholder. The Place Graph on Layout

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dialog lets you choose to merge the graph and data into the new file, to maintain a link to the original Prism file so that changes in the original will update in the current file, or to paste just a picture of the graph.

Splitting

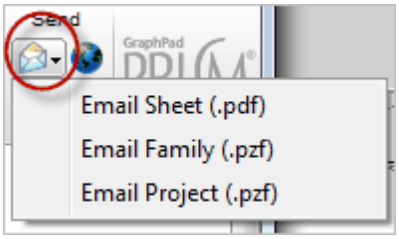
Prism offers two approaches to splitting apart a Prism project.

- To save one family of sheets into a new file: Drop the File menu, choose Save Special, and then Save Family As. This will create a new file from the current sheet along with all linked sheets.

- To save a copy of the entire project with a new name: Drop the File menu. In Windows, choose Save As. In Mac, choose Duplicate.

Once you've saved a copy of the file, or part of it, you'll want to delete unwanted sheets from the original project. The easiest way to delete several sheets is to go to the Gallery for a section and click the checkbox on several sheets. Then press Delete. When you delete a data table, you have the option to delete all info, results, and graph sheets linked to the selected data tables at the same time.

8.5 Emailing Prism files to colleagues



Click on the Send by Email button in the Send section of the Prism toolbar. You can choose to send a Sheet, Family, or Project. Your email program will open and create a new message with the Prism file attached. The format of the file depends on what you choose:

- If you choose to send a data table or results sheet, it will be sent as a text file.

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- If you send a graph or layout, Prism will send it as a .PDF file.
- If you choose to send a family or project, Prism creates a temporary copy of the project, and attaches that to the email. Changes you make after choosing the Send Mail command will not be included in the email, even if you delay sending it.

These commands probably won't work if you use a web-based email system or a nonstandard email program. If the command doesn't work, or isn't available, you can still attach Prism files to email. Simply save the file, and then attach it to an email from your email program. If you only want to send a subset of your project, save the current sheet and all related sheets using the Save Family As command. Choose Save Special from the File section of the Prism toolbar.

You can send a Prism file even to someone who doesn't own Prism. The recipient can view the file using a free Prism trial. After the trial expires in 30 days) it becomes a Viewer that doesn't expire. It lets anyone view and print all contents of a Prism file, including analysis choices, but does not allow any editing or exporting.

8.6 LabArchives

Far more than an "ELN" (Electronic Laboratory Notebook), LabArchives stores and catalogs all of your research for easy retrieval and publication.

Free LabArchives account for Prism users

Registered users of Prism can obtain a free account on LabArchives. To set up this account, go to a graph in Prism, click the LabArchives button to drop a menu, and choose to "LabArchives it". You will be prompted for your email address, which is all you need to start an account. You do not need to enter a credit card number!

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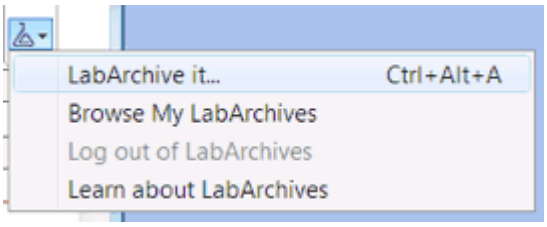

Prism integrates well with LabArchives:

- Click "LabArchive it" to upload files directly to LabArchives.
- When it uploads a file to LabArchives, Prism also sends LabArchives a list of all words used in notes, titles, text boxes, etc. That mean you can search within LabArchives to find the file you need.
- From the Welcome dialog of Prism, you can open a file directly from LabArchives. There is no need to first go to labarchives.com to download the file you want.

Logging on to an existing LabArchives account

If you have a LabArchives username and password, Prism will prompt you to enter it.

But what if you log in to your institutional server, and the logging into LabArchives is done behind the scenes using an authorization system like Shibboleth? In this case, you don't have a username and password specific to LabArchives. But you can get one. After logging into the LabArchives web browser interface, click on your name in the upper right-hand corner of the screen and click "LA App authentication". The next screen will show you a username (email) and password for LabArchives. Use these when Prism asks you to log in to LabArchives. Prism will remember this information, so you should only need to do this once.

LabArchives usually uses a server maintained by LabArchives. If you want to use a local server to host LabArchives files, you can do so. Details here.

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8.7 Saving vs. exporting

Saving and exporting are different. When you Save your Prism file you save it in Prism's file format. This type of file can only be opened with Prism and it contains data, analyses and graphs.

Use Export to save a graph or layout in an image format that can be imported to another application. If you export a graph 576 or layout, you are simply creating a picture of it. You won't export the original data or any analysis results. You won't be able to open the exported file or edit it, except as a picture. If you export a data table 291 as a text file, you are just exporting the values.

8.8 Template, method and example files

Prism can save your work in three special kind of files designed to let you save time by not repeating steps with future data.

- A *template* is a Prism file that you recycle. Choose a template, add new data, and all the analyses and graphs will be created automatically. Templates 176 are an older feature, and we recommend you use example files or method files instead.

- *Example files* are files saved in a special location to later be cloned. Choose to clone an example file 173 on the Welcome (File..New) dialog, enter new data, and all the analyses and graphs will be remade.

- Method *files* are files saved in a special location to later be applied to new data you have entered. When you apply a method, you apply the analyses and graphs in the method file to the data table you have already entered. Do so in the Analyze dialog.

Save your work as a template, example or method from commands in the File... Save special menu. To save an example, you must be looking at a graph when you save the example. To save a method, you must be looking at a data table. Templates can be saved from anywhere.

8.9 Automatic backups of Prism files

Automatic backup depends on platform.

Automatic backup for Prism Windows 128

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Automatic back for Prism Mac 134

9 Work efficiently. Repeat analyses and graphing

Once you've analyzed data and made some graphs with Prism, you'll probably want to do similar analyses and make similar graphs with new data.

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Don't start again from scratch. Prism offers four ways to recycle -- to quickly analyze and graph new data using the same steps and format that you used earlier. The key point is that Prism links data to results, graphs and layouts. If you edit or

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replace data, linked results, graphs and layouts are updated automatically.

- When you fix a mistake in data entry, the results and graphs are automatically updated.

9.1 Duplicate a family of sheets

A family 150 is defined to be a selected sheet and all linked sheets.

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To duplicate a family of sheets, do one of the following:

- Click the New button and choose Duplicate Family.
- Drop the Family menu and choose Duplicate Family.
- Right click (or Control-click if using a Mac) on any sheet in the Navigator, and choose Duplicate Family

If you are starting from a data table, Prism will ask you to assign a name to the new (duplicated) data table. If the table name is a subset of the results and graph sheet names, these will be substituted. Suppose that the data table is "October data", and is linked to "Nonlin fit of October data" and "Graph of October data". If you start from the data table and choose to duplicate family, you can enter "November data" as the name of the new data table. Prism will then rename the linked sheets to "Nonlin fit of November data" and "Graph of November data". It can only do this because the exact name of the data table is part of the sheet names.

If you are starting from another kind of sheet, Prism will ask you to enter a prefix that will be prepended to the names of all the duplicated sheets. In the example above, you could choose to preface all the newly created sheets with "* ". These new sheets will be "* October data", "* Nonlin fit of October data" and "* Graph of October data". Of course, you can rename the sheet titles however you want.

If you are not starting from a layout, Prism will ask whether you want to include the layouts in the duplicated family.

Prism will duplicate the current sheet and all linked sheets. Replace the data on the new data table, and all analyses and graphs will update.

Note the distinction between duplicating a sheet, and duplicating a family of sheets. When you duplicate a sheet, only that one sheet is duplicated. If you duplicate a data table, it will not be linked to any graphs. If you duplicate a graph, the copy will link to the same data table as the original. This is useful if you want to make two graphs of the same data. But if you want to make two similar graphs of different data, you'll want to duplicate the family (or clone the graph 173).

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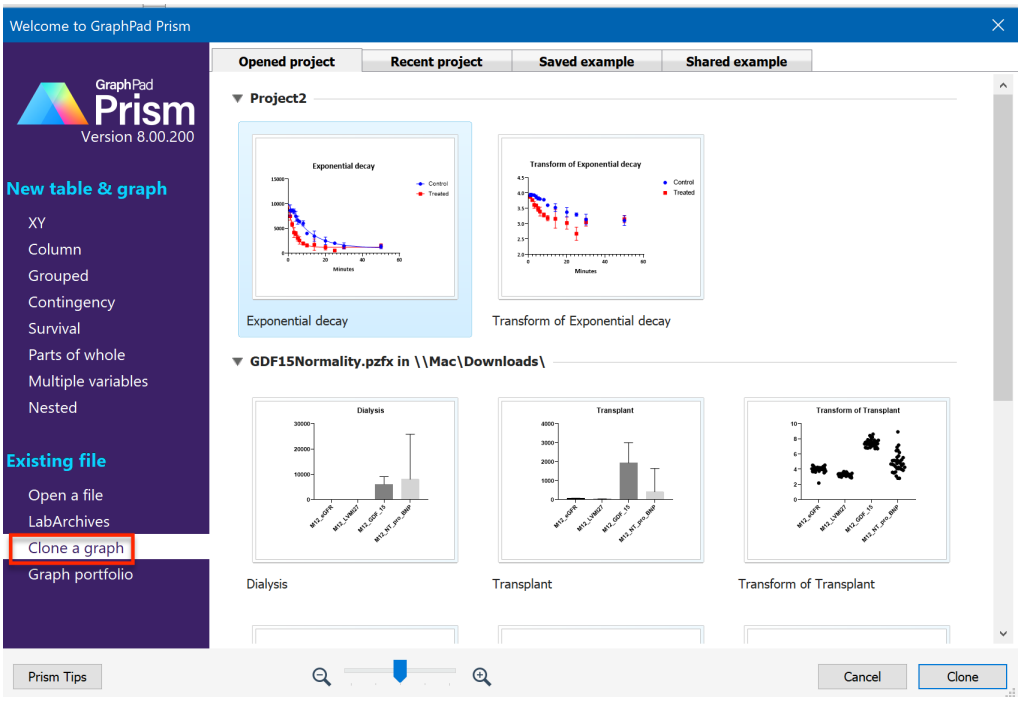
9.2 Clone a graph

Cloning means to duplicate a graph along with data tables and results included on that graph. Enter a new data set, and it will instantly be graphed the same way. Clone a graph when starting a new project from the Welcome (File..New) dialog. Or drop the New button and choose Data Table (+ Graph).



Use the tabs at the top of the window to choose graphs from an open project, a recently-used project, or a Prism project that you have saved as an example or has been saved as a shared example 654. At the bottom of the dialog is a control where you can choose the size of the thumbnails.

Once you choose the graph to clone, Prism will show a dialog where you can choose which data and titles to delete. By default, Y values are deleted, but X values and titles are kept.

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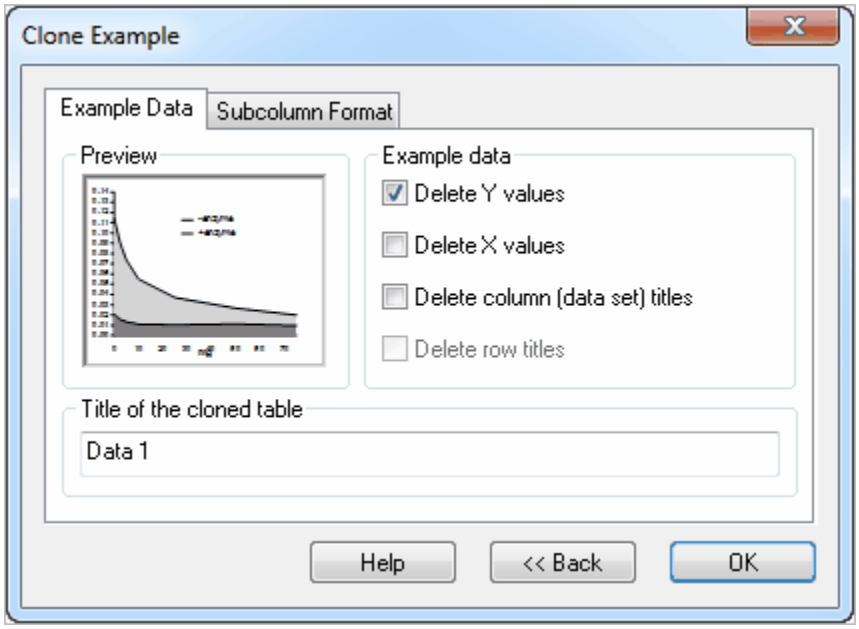

Q&A:

- Are analyses also cloned? It depends. Cloning duplicates regression lines and curves,and results tables that are included on embedded tables. Other analyses that are linked to the original data table, but are not included on the graph, are not cloned. For example, say you have a data table, analyzed with a t test, and graphed. If you clone the graph, the t test analysis will only be included if you have pasted a portion of the results onto that graph.

- To save the current graph as an example to clone in the future, drop the File menu and choose Save Special ...Save as Example. Start from a completed graph. Don't erase the data before saving the example, as you can ask Prism to remove the data when you clone the example.

- Can you clone layouts? No. But you can go to any layout, and duplicate that sheet with its family 171.

- How is cloning a graph different than duplicating a family of sheets? When you start from a graph, and duplicate its family, the results are identical to cloning that graph. To clone a graph, go to the Welcome (File..New) dialog. To duplicate a family, go to the selected sheet.

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9.3 Use Wand to analyze and graph just like another table

If you've already entered data onto an empty data table, it is too late to clone, too late to duplicate a family, and too late to open a template -- at least without copy and pasting data.

Prism provides a great tool to solve this problem: the Wand (Wizard to ANalyze Data). Use it to analyze (and graph) the new table just like you already analyzed (and graphed) an existing table.

Follow these steps:

1. Start from the data table (with data) you wish to analyze (and graph). Or select multiple data tables in the gallery.

2. Click the magic wand button on the toolbar, to bring up the Analyze Data dialog.

3. Choose the existing data table (in the current project) you want to use as an example.

4. At the bottom of the dialog, optionally enter the prefix you wish to appear in front of the new sheet names.

That's it. The new table (where you started from) will be graphed and analyzed the same as the example table.

Notes:

- The name *Wand* was new to Prism 6. This feature used to be called *Applying a Method*.

- You can also choose to use the Wand to apply a stored method file. To save a method file, go to the data table that has been analyzed and graphed, drop the File menu and select Save Special… Save Method. Where is it saved? 654 To apply that saved method file, click the Analyze

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button, and then choose Use Saved Method at the top left of the Analyze Data dialog.

- The same icon is used for both the Magic 347 and Wand features. Magic (Make Graphs Consistent) changes the appearance of selected graphs so they look like an example graph. You can only use Magic when you start from a graph, or a set of graphs selected in the gallery. The Wand analyzes and graphs a new table the way you have already analyzed and graphed another table. You can only use the Wand when you start from a data table with data, or a set of selected tables.

9.4 Templates

What is a template?

A *template* is a Prism file that you recycle. Choose a template, add new data, and all the analyses and graphs will be created automatically. Templates are an older feature, and we recommend you clone a graph 173, or use the Wand 175, instead.

A Prism template is a regular Prism file, with three differences:

- A template has the extension .pzt. When Prism opens such a file, it will "forget" the file name and open the file without a name. Then it will prompt for a file name when you save. This prevents accidentally overwriting the template.

- When you save a template, you can enter some brief instructions that will appear when the template is opened. This can be useful when you are creating a template for others to use.

- A list of templates will appear on the Open a File tab of the Welcome (File..New) dialog.

Creating a template

Follow these steps to create a template:

1. Create a Prism project with only the sheets you want to see when a template is opened.

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2. (Optional) Delete the portions of the data that will change with each experiment (for example, delete the Y values but leave the X values and the column titles). Don't delete entire columns, just the values in those columns by selecting and then using the Delete key.

3. Go to the data table you want to see when the template is opened, drop the File menu, choose Save Special, and finally choose Save Template. You'll also find this command if you drop the Save menu from the toolbar. This command will be gray (unavailable) unless you are looking at a data table (not results or graph).

4. On the Save Template dialog, choose (or create) a category (folder), enter a name for the new template, and optionally enter a description and/or instructions for using the template. If it will be used by others, you can write a help file for it and install the files onto other computers. 654

To use a template

You'll see a list of templates at the bottom of the Open a File tab of the Welcome (File..New) dialog. When you open a template, any description of instructions you entered will appear in a popup dialog.

Informal templates

The instructions above assume that you save the template from Prism, and open it via a link on the Welcome (File..New) dialog. But you can rename any Prism file in any folder to have a .pzt extension, and open it from Windows Explorer or Mac Finder by double-clicking on it. The difference is that when Prism opens a .pzt file, it instantly forgets the file name so will prompt you for a file name when you first save it. That way you won't accidentally overwrite the template.

9.5 Template or method (wand)?

When you want to analyze and graphs a set of experiments the same way, you can save your example as either a template or method. In

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either case, start from the data table, drop the File menu, choose Save Special..., and then choose Save Template or Save Method.

The difference is in when you choose to use these files.

- Open the template from the Welcome dialog, enter or import data, and then look at (and fine-tune) the results and graphs.

- Methods are different. First create a data table and enter or import data. Only then do you click the Analyze button to apply the method to your data.

Perhaps this distinction will help: A template is a noun - a place you start from. A method is a verb - something you apply to data you have already entered

.

10 Organizing Prism projects

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A Prism project file (or PZF file) contains all the pieces of a project. Each Prism project has basic five sections: Data tables 198, Info sheets 185, Results 296, Graphs 391, and Layouts 544. Each section can have up to 500 sheets. The term 'sheet' refers

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to an individual data table, info page, set of results, graph or page layout.

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10.1 Renaming, sorting, and deleting sheets

Changing the order of sheets in a section

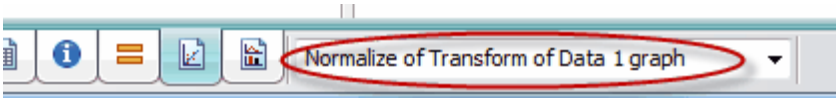
Simply drag-and-drop within the Navigator 146 or Gallery 182, or pull down the Edit menu and choose Reorder

Renaming a sheet

Prism initially assigns each data table a generic name such as "Table 1." It is easier to manage large projects if you give the sheets more descriptive names.

Click on the name of the sheet in the Navigator, and press F2 (or wait for a second and then click again) to rename the sheet. Or right-click on the sheet name and choose Rename sheet.

You can also rename using the bottom toolbar. Click on the sheet name in the bar at the bottom of the Prism window and edit it. Don't try to delete the current sheet name from the drop down in the bottom toolbar. If you delete the name, Prism replaces it with a default name. Instead, double-click on the sheet name in the bottom toolbar to select it, and then begin typing to replace it.



Deleting sheets

Select a sheet in the Navigator 146 and click the Delete Sheet(s) button on the Sheet toolbar. You can select one or more sheets in the current section to delete.

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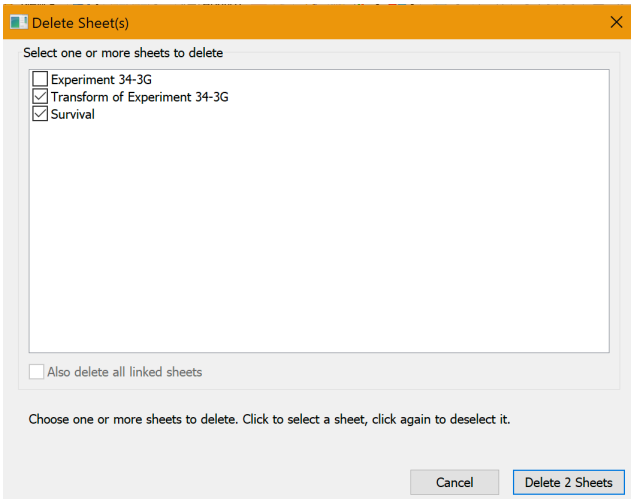

To delete several sheets,go to the Gallery 182 and select several sheets. Then click the Delete Sheet(s) button or press the Delete key.

Because sheets are linked, remember that deleting one sheet may affect others. When you delete a data table or results sheet, you also remove those data and results from all graphs. The graphs themselves remain; they just have fewer (or no) data plotted on them. Any results sheets based on the deleted data become orphaned (you can still view and graph orphaned results but can't change the calculation parameters). When you delete a graph sheet, you also delete that graph from all page layouts, but you will not delete the page layout sheets themselves.

10.2 Working with multiple sheets at once

View all sheets in the gallery

Click a section title in the Navigator (Data tables, Info sheets, Results, Graphs, or Layouts) to view thumbnails of all the sheets in that section. We call this the Gallery.

Use the Zoom buttons on the bottom toolbar to make the Gallery thumbnails larger or smaller.

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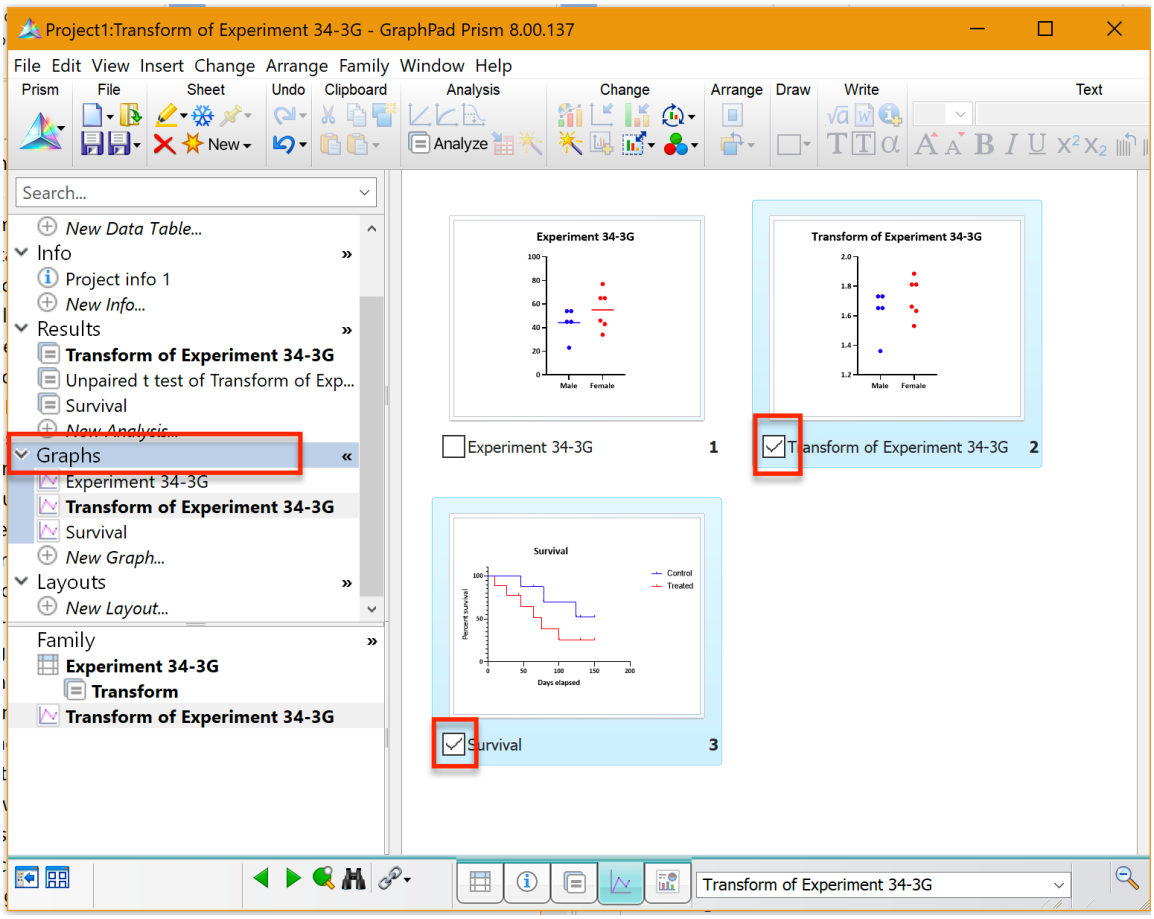
The gallery is useful for navigation and organization. Double-click on any sheet to go to it. Drag and drop thumbnails in the Gallery to rearrange sheets in a section.

Selecting multiple sheets

Check this option box below each sheet to select it. Alternatively, hold the Control key while clicking on several sheets.



Working with several sheets at once

Many commands are available that work on all selected sheets at once. Right click on the gallery to see a list of all available commands.

- Print 598 each selected sheet separately, or print a combined gallery page.

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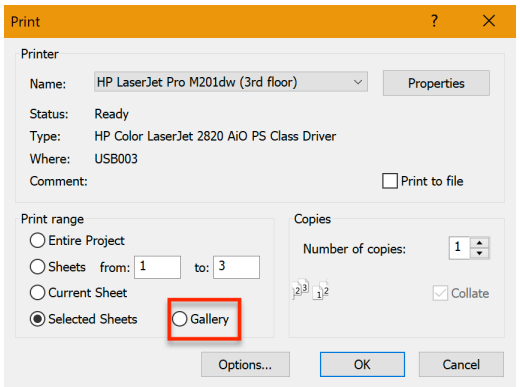
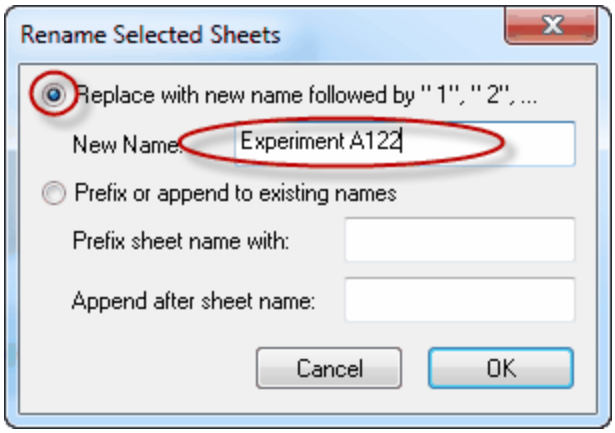


- Export 574.
- Send 592 to Microsoft Word or PowerPoint.
- Magic 347. Make graphs consistent.
- Apply a color scheme 362
- Change the background color or plotting area color 362
- Rename. Add a prefix or suffix to their existing names, or give all selected sheets the same name (followed by 1,2,3...).



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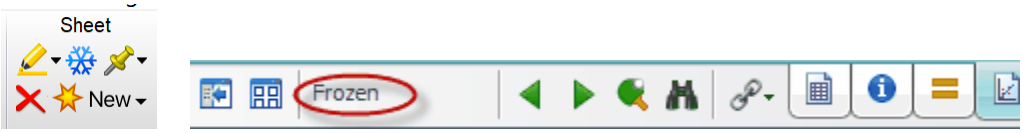
10.3 Freezing a sheet to prevent changes

When you edit data, Prism automatically recalculates the analyses and updates the graphs.

Freeze a results or graph sheet if you don't want it to update. For example, you might want to freeze results and a graph before excluding some outliers from the data. You can then repeat the analysis, and have both copies of the results and graphs in the project. Note that Prism doesn't let you freeze data tables, info sheets, or layouts.

Click the Freeze button in the Sheet section of the Prism toolbar to freeze a results sheet or graph. The Prism bottom toolbar will indicate that the sheet has been frozen and won't update with any changes to the data. Click again to unfreeze.



10.4 Using Info sheets to organize your projects

Key concepts: Info sheets

- Use Info sheets to record experimental details and constants you want to use in analyses.
- The left side of an info sheet is a table of structured information. The right side is for unstructured notes
- Each project can have up to 500 info sheets. Each Info sheet can be linked to a particular data table, but doesn't have to be.
- The info constants can be used (hooked) in analyses.

Create and edit an Info sheet

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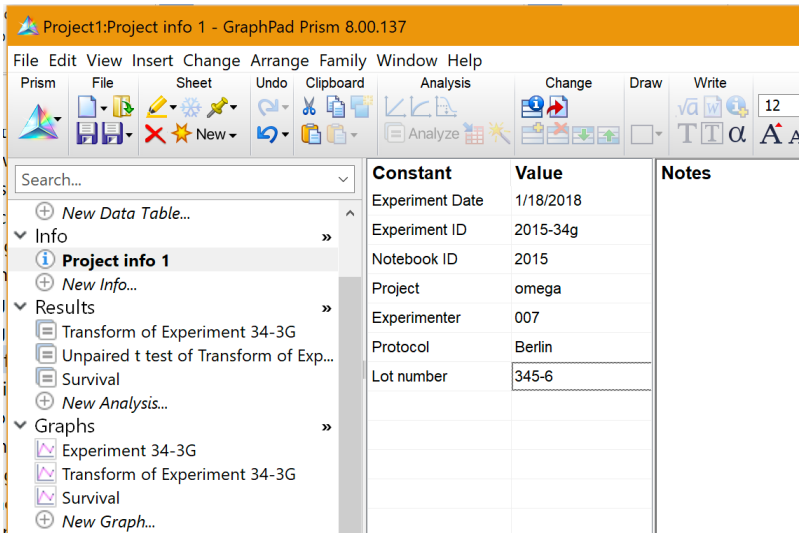
To create an info sheet, click the New button on the toolbar, or drop the Insert menu. Choose New Info. Select whether the new sheet should be linked to a particular data table, or a global Info sheet for the project.



How to use Info Sheets

To embed all or part of an Info table onto a graph or layout:

Select all or part of the Info table, and copy to the clipboard. Then go to a graph or layout and paste. This will be a live link, updated if you edit the info table. Double-click on the embedded table to adjust its properties.

To insert an Info constant into a graph title, legend, or text object:

While entering text, use the right-click menu or click on the Inset Info Constant button in the Write section of the Prism toolbar. Prism will maintain a link to the constant, updating the text when you edit the info table.

To change the order of the rows on an Info sheet, or to delete a row:

Click on a row, then click the right mouse button. From the shortcut menu, choose to move the selected row up or down, or choose to delete that row. Or use the buttons on the Change toolbar.

To link a global Info sheet to a specific data table:

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Click this button in the Change toolbar to bring up a dialog to select which data table the Info Sheet is linked to.

To change which info constants appear by default on new Info sheets:

Use the Info Sheet tab of the Preferences 191 dialog. You can also choose whether or not Prism will automatically create a linked Info sheet to accompany every new data table you create

To import info constants into an Info sheet at the same time you import data:

See here for the details. 287

To hook info constants into an analysis or graphing dialog.

You can "hook 306" Info sheet constants as constraints in nonlinear regression or as constants when transforming.

You can also Hook to Info sheet constants to create custom ticks 503, set axis limits 493, etc.

You'll know when it's possible to insert ("hook") an info constant, because you'll see the fishhook icon next to the number entry field.

When you see this button in a dialog, click on it to bring up a list of all Info and Analysis constants that can be hooked.

To insert a text file into the notes portion of an Info sheet:

Drop the File menu and choose Import.

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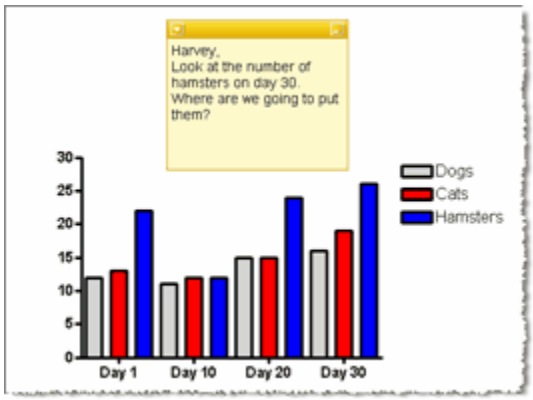
10.5 Annotating your work with floating notes

Floating notes will show on the sheet but not when a sheet is printed, or exported or copied to another application, such as Word or PowerPoint. Use different color notes for different things. For example, have one colleague review all yellow notes, and another one review all the blue notes.

To add a floating note to a Prism sheet:

Click on the button on the Sheet toolbar.



To minimize a floating note:

- Click the Minimize button on a Floating Note to collapse the note. Or just double-click on the top border of the note.

To add a link to a web site:

- Drop the Note menu using the button in the upper left corner of a note and use the Create Link to add a hyperlink to a website or other document.

To change the color or delete a floating note:

Drop the Note menu using the button in the upper left corner of a note, and select Note Color.

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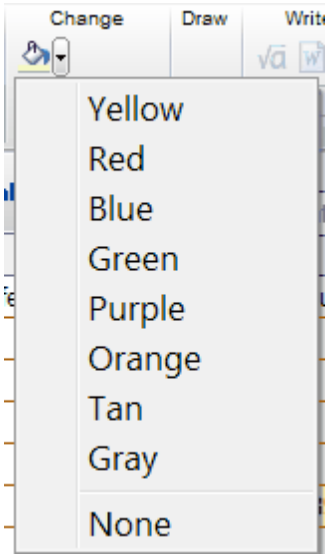
10.6 Color code selected cells in data or results tables

It is easy to color code selected cells in data or results tables. This would be useful to highlight the key results, to mark surprising results you wish to review further, or to mark suspicious data entries that you wish to double check. To do so:

1. Place the insertion point in the single cell you wish to color code. Or drag to select a range of cells.

2. Click the paint bucket icon in the Change area and choose a color. Or drop the Change menu and choose "Cell Background Color".



Note the distinction between two related features. You can highlight (color code) sheet names in the navigator, and you can also color code the background of selected cells in data and results tables.

10.7 Highlighting sheets in the Navigator tree

Highlight a sheet name to remind yourself to go back to it, or to flag sheets you want a co-worker to view. You can choose among seven colors.

Select a sheet in the Navigator, or several sheets in the Gallery 182, and click on the Highlight button on the Sheet toolbar. Click on the highlight button itself to use the same color as last time, or click the arrow to choose a color.

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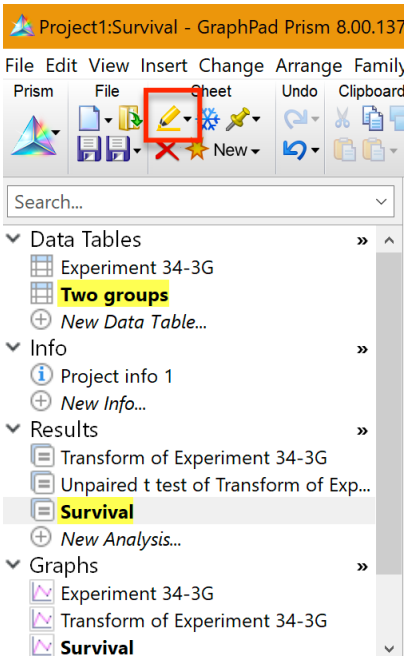

10.8 Grouping related sheets

Prism offers no way to create subfolders or to group sheets within a section (except by color coding 189 them). But one of our customers came up with a clever workaround. He creates extra data tables or graphs (which can be ignored) and renames the sheet title to "-------". This has the effect of dividing a long list of sheets into sections.

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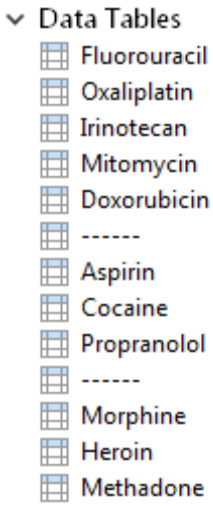


10.9 Preferences

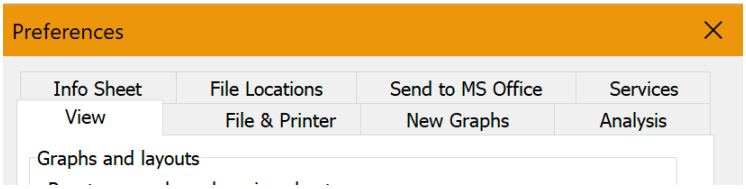
Overview

Use the Preferences dialog to set Prism's defaults for various settings.

Note that some preference settings are made elsewhere in Prism. The import 278 (paste special) dialog, the export graph 576, and the diagnostics tab of nonlinear regression, for example, all have check-boxes to make the current settings default for the future.

Also note that on Macs, there are two settings in the General tab of the System preferences 135 dialog that have a big effect on how Prism works.

To open the Preferences dialog, drop the Edit menu (Windows) or Prism menu (Mac) and choose Preferences.



Most of the settings are self explanatory. The rest of this page discusses the settings that are not entirely self-explanatory.

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View tab

- Reset zoom. If you zoom to make a graph or layout larger or smaller and then view a different graph or layout, what happens? Keep the same zoom, or reset to a default zoom?

- Antialiasing. Prism uses antialiasing to improve the appearance of graphs on screen. When curves or lines are drawn in black on a white background, antialiasing fills in gray pixels in the corners to reduce the jagged look. Prism Mac gives you no choice. Prism Windows offers an option to turn of antialiasing, which improves the look on some old computers. Note that antialiasing only affects the appearance of graphs and layouts on screen those exported or copied in EMF+ format, but has no effect on the appearance of printed graphs or those exported in WMF, EMF(old), PDF, EPS, PNG or JPG formats.

- Default fonts.

- Inches or cm?

- Autocomplete titles after you type the first few characters?

- Show alerts on graphs with missing error bars, points off scale, etc. ? Untl Prism 7, these alerts tended to be long and a bit annoying. Prism 8 makes then much shorter, but you can turn them off altogether if you want to.

File and Printer tab: Automatic backup

Choose to backup whenever you move to a different sheet and by timer every K minutes (you specify K). For Windows, you can also ask Prism to backup files when you close a file and choose not to save it (it will show on Welcome dialog).

Read more about autobackup 128.

File and Printer tab: File format

- Default to saving in PZF orPZFX format. 160

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- If you use PZF format, do you want to use the compact style? All this format does is leave out analysis results (and instead recomputes them when you open the file). It makes the file a bit smaller, but PZFX files are way smaller. PZFX files never include analysis results which always need to be recalculated when you open the file.

File and Printer tab: Print options

- When Printing tables, choose whether to print grid lines and column titles.

- For all printing, deciding whether you want a header with file name, date and time.

File and Printer tab: Copy to clipboard options

- How to copy graphs and layouts to clipboard (Windows). Prism gives you a choice of three formats: WMF, EMF (old) and EMF+. In theory, EMF+ is the best because it is newest. But it all depends on which application you are pasting into. You may need to experiment.

- How to paste a graph from another project (Mac). Choose whether the pasted image needs to be Windows compatible (which increases file size, and on slow computers may noticeably delay pasting).

- When copying a graph or layout, include the background color or not. If you choose not to include the background color, the background will be clear (transparent). How that looks depends on what you are pasting onto. This option applies when copying a graph or layout to the clipboard. If you use Send to Powerpoint instead, Prism always makes the graph or layout transparent so the PowerPoint background shows through.

- When copying numbers, what to do with missing values. They can be left blank, be pasted as numbers followed by an asterisk, or pasted as regular numbers.

- Use comma or period as the decimal separator.

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- When copying numbers where Prism knows more decimal places than it shows on screen, paste all the digits or just those shown on screen.

New Graphs tab

Set defaults for axes, error bars, symbols and lines, color schemes, and graph and data table fonts. These defaults apply to newly created graphs, but don't change existing graphs.

Analysis tab

Most analysis options are set on the various analysis tabs which have a check box to make those settings the default for future analyses. Not all anlayses, and not all tabs in the analysis dialogs offer this choice.

There is only one choice in Preferences. Many analysis tabs give you a choice for how to format P values. These choices offer a choice to show N digits after the decimal, where you set N. The preference tab lets you choose the default N and to choose when/if to use scientific notation.

Info sheets tab

Choose whether to create an Info table 185 (for entry of meta data and notes) for each new data table, and what items to include by default.

File locations

Set the default location for saving Prism files, for importing/exporting data, importing/exporting graphs and layouts, scripts and templates. Note that templates are saved to, and read from, folders within the folder you specify but not in that folder itself.

Send to Office (Windows only)

Prism has buttons to send a graph or layout to Word or PowerPoint, and you can set several options for how this is done.

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Services tab

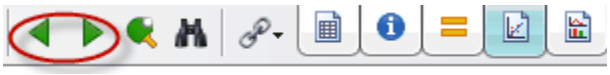
Option to automatically check for updates and let you know if there is one. Also an option to create an extended log file to troubleshoot unusual problems.

10.10 Tips for navigating large projects

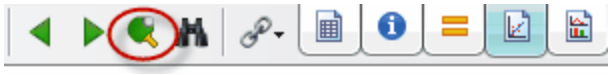
A Prism project file can have up to 500 data tables, info tables, analyses, graphs and layouts. Lump lots of data into one file? Or split into many files? The choice is yours. If you prefer to create large projects, use these tools to navigate:

Use the bottom toolbar

Browse the sheets sequentially.



Ping pong between any two sheets. Click once to go back to the previous sheet. Click again to return.



Pick from a menu of sheets linked to the current sheet, or use the five tabs to jump between sections.

Navigate within sheets in a family

At the bottom of the Navigator tree, you'll find links to all the sheets in the current family 150. When you select a sheet in any section of the Navigator, all the related sheets -- data tables, graphs, info sheets, results, and layouts will be grouped and shown in the Family section.

Navigating in the family pane is especially useful when working with a project with lots of sheets. It lets you move between related sheets without scrolling the Navigator.

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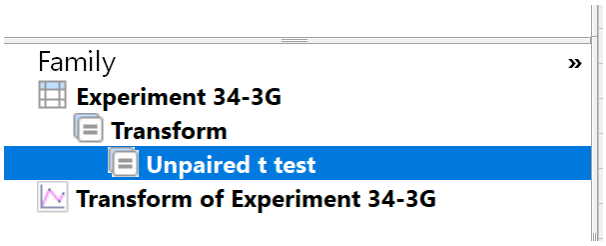
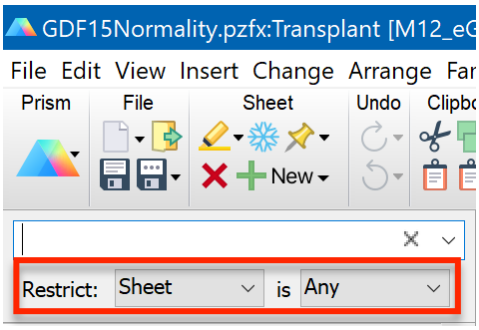
Working with chained analyses

Prism lets you chain analyses. For example, you can first transform data, then normalize the transformed data, then fit a curve to the normalized results, and finally run a normality test on the residuals from the curve fit. The family pane at the bottom of the navigator always shows analyses indented under the table being analzed.



Use the Search tool

Use the search tool above the navigator to find pages (sheets) with certain text. The results will appear in the Navigator. Prism searches for the text you entered in titles, floating notes, sheet names, and more. It only searches within the current file, and does not search within other files that might include the search text.



Click the close X button in the search area to return to the usual navigator.

Navigator tool tips

If you've got lots of sheets in a project, and you're not sure which one you are looking for, hover your mouse over any sheet name in the Prism Navigator 146 to display a thumbnail of the sheet.

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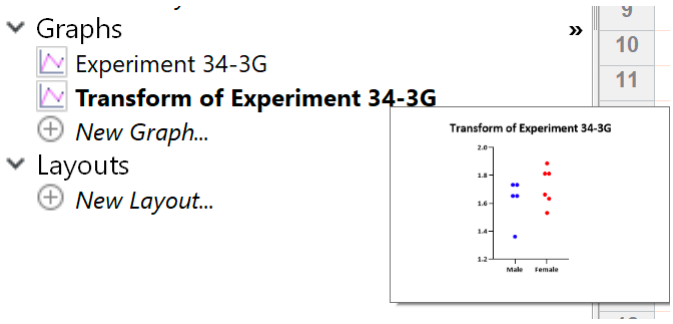

Highlight or move selected sheets

If you identify certain sheets that you want to go back to frequently:

- Highlight 189 the sheet name in a color you choose. Use the highlight button in the toolbar, or right click on the sheet in the navigator and highlight from there.

- Move 181 them to the top of the list in the navigator. Just drag and drop.

10.11 Tips to avoid the need for large projects

Delete sheets you don't need

As you work on a project, you might accumulate graphs and analyses which you don't need. Keeping them in the project adds clutter and makes it harder to find the sheets you want. Delete them 181.

Save families of sheets

If a file is large, consider breaking it into smaller projects. You can save any family of sheets as a new project. Find the command "Save Family As" on the File menu.

Merge Prism files

If you later want to merge two files, that is straightforward. Use the Merge command on the File menu.

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Place a graph from one project on a layout of another

You can place a graph from one project onto a layout of another project. There are two ways to do this:

- Double click on a placeholder in the layout, and choose a graph from another open project.
- Copy the graph from one project, go to the layout of another project, make sure no placeholders are selected, and paste. Prism will give you three choices:to paste a picture, paste a hot link, or to paste merge, so the entire family of the pasted graph is merged in.

11 Data tables

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Unlike Excel or most other graphics programs, Prism's data tables are formatted. In most cases, the first column is for X. The rest of the columns are for Y values, and these can be divided into subcolumns for entry of error bars.

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11.1 Distinguishing the eight kinds of data tables

Unlike the data tables of most programs, the data tables in Prism have a format or structure. There are eight different kinds of tables, and it is

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essential that you pick the right one for your data and experimental design.

11.1.1 Key concept -- data tables

Choosing among the eight kinds of data tables is important

The format of a Prism data table determines what kinds of graphs you can make and what kind of analyses you can perform. Choosing the right kind of table for your data is really important. Take the time to get this right.

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Don't try to choose the right kind of table for your data by thinking about the kind of graph you want to make. That approach will end up confusing you because there isn't a one to one match between table and graph types. For example, you can make a bar graph from five kinds of tables224, and a graph showing points (a scatter graph) from three kinds of tables228. You need to choose a table based on the organization of the data and the analyses you wish to perform.

Prism projects can have many data tables

You are not limited to one data table per file. Store an entire project in one file, creating as many data tables as you need.

Prism can compute error bars

Prism can plot error bars from raw data. You don’t have to enter SD or SEM values, although you can.

11.1.2 Prism's eight data table formats

The format of a Prism data table198 determines what kinds of graphs you can make and what kind of analyses you can perform. Choosing a data table format lets Prism create a data table that fits your data and makes it easy to create the kind of graph you want and perform the appropriate analyses. You can always change238 the format of a data table.

The eight kinds of data tables

XY tables206 - An XY table is a graph where every point is defined by both an X and a Y value. This kind of data are often fit with linear or nonlinear regression.

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Table format: XY		X	A		
		minutes	Test group A		
		X	A:Y1	A:Y2	A:Y3
1	Title	0	0.0	0.0	0.0
2	Title	2	391.0	384.0	543.0
3	Title	4	562.0	478.0	584.0
4	Title	6	746.0	798.0	715.0
5	Title	8	823.0	754.0	669.0
6	Title	10	736.0	846.0	742.0
7	Title	12	832.0	855.0	799.0
8	Title	14	923.0	750.0	816.0
9	Title	16	801.0	854.0	826.0
10	Title	18	811.0	795.0	864.0
11	Title	20	942.0	831.0	938.0

Column tables 210 - Use column tables if your groups are defined by one scheme, perhaps control vs. treated, or placebo vs. low-dose vs. high-dose. Each column defines one group.

	A	B
	Placebo	Active drug
	Y	Y
1	45	67
2	23	46
3	56	113
4	76	79
5	81	123
6	87	
7	99	

Grouped tables 212 - The idea of two-way variables is best understood by example. One grouping variable (male vs. female in the example below) is defined by rows; the other grouping variable (control vs. treated) is defined by columns.

		A			B		
		Control			Treated		
		A:Y1	A:Y2	A:Y3	B:Y1	B:Y2	B:Y3
1	Men	34.5	32.9	43.3	87.5	*321.5**	81.7
2	Women	42.3		45.9	109.4	111.2	115.4
3	Title						

Contingency tables 214 - Contingency tables are used to tabulate the actual number of subjects (or observations) that fall into the categories defined by the rows and columns of a table.

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		A	B
		Graft Patent	Graft Obstructed
		Y	Y
1	Standard treatment	45	5
2	Experimental treatment	49	1

Survival tables 216 - Survival tables are used to enter information for each subject. Prism then computes percent survival at each time, and plots a Kaplan-Meier survival plot (and also compares survival with the log-rank and Gehan-Wilcoxon tests).

		X Values	A	B
		Days	Convetnional	Experimental
		X	Y	Y
1	YO	34	1	
2	US	56	1	
3	HO	23	1	
4	UL	114	0	
5	DN	89	1	
6	OT	214	1	
7	BE	87		1
8	RE	145		0
9	AD	46		1
10	IN	112		1
11	GT	231		0
12	HI	98		1

Parts of whole tables 218 - A Parts of whole table is used when it makes sense to ask: What fraction of the total is each value? This table is often used to make a pie chart. The example below shows the number of students who received grades of A, B, C, etc. The sum of the five values in the table (61) is the total number of students.

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Table format: Parts of whole		A
		Number of Students
		Y
1	A	23
2	B	29
3	C	7
4	D	2
5	E	0

Multiple variable tables 219. A multiple variable table is arranged the same way most statistics programs organize data. Each row is a "case" (experiment, animal, etc.). Each row is a different variable. There are no subcolumns in multiple variable tables.

Table format: Multiple variables		Variable A	Variable B	Variable C	Variable D	Variable E	Variable F	Variable G	Variable H	Variable I	Variable J
		Glycosylated hemoglobin %	Total cholesterol	Glucose	HDL	Age in years	Male?	Height in inches	Weight in pounds	Waist in inches	Hip in inches
1	Title	4.309999943	203	82	56	46	0	62	121	29	38
2	Title	4.440000057	165	97	24	29	0	64	218	46	48
3	Title	4.639999866	228	92	37	58	0	61	256	49	57
4	Title	4.630000114	78	93	12	67	1	67	119	33	38
5	Title	7.719999790	249	90	28	64	1	68	183	44	41

Nested tables 220. A nested table is used when there are two levels of nested or hierarchical replication. In this example, there are two treatments given to three rats each and the outcome variable was measured four times in each rat.

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	Group A			Group B		
	Teaching method A			Teaching method B		
	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6
1	21	18	35	26	38	31
2	26	25	28	34	44	41
3	33	26	32	27	34	34
4	22	24	36		45	35
5		21	38		38	38
6		25				46
7						

11.1.3 XY tables

In an XY table, every point is defined by both an X and a Y value.

Analyses performed with XY data

- Nonlinear regression (curve fit)
- Linear regression
- Fit Spline/LOWESS
- Smooth, Differentiate or Integrate Curve
- Area Under Curve
- Deming (Model II) Linear regression
- Correlation matrix
- Correlation XY
- Interpolate a Standard Curve

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Example of an XY table

Table format: XY		X	Group A			Group B		
		Seconds	Control			Treated		
		X	A:Y1	A:Y2	A:Y3	B:Y1	B:Y2	B:Y3
1	Title	1	35	31	42	36	39	25
2	Title	2	43	49				
3	Title	3	50	57	67	87	89	62
4	Title	4						
5	Title	5	77	89	99	102	145	154
6	Title	10	145		121			
7	Title	15				254	269	231
8	Title	20	167	187	145			
9	Title	25				289	296	271
10	Title							

- The first optional column is for row titles 247 to label individual subjects or samples.
- The next column ("X") is for X value. There is only one X column per table. If you choose to enter X error values, then there will be two subcolumns (one for X, one for the error value).
- Each remaining column ("A", "B", ...) defines a treatment group.
- Subcolumns 372 are for replicates in a treatment group. Prism uses these to calculate error bars.
- Blank cells represent missing values.
- Blue italics values are excluded 253 from graphs and analyses.
- An XY data table can contain 256 data set columns and as many as 256 sub-columns.
- XY tables can be configured to enter dates or times into the X column, instead of numbers. Choose when you create table.

Error bars

Prism will compute and graph error bars from replicate values placed in side by side subcolumns as shown (triplicate values) in the table above. Specify the number of subcolumns when you create a new XY table.

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You can also choose to create subcolumns formatted for entry of error values computed elsewhere.

Table format: XY	X	Group A			Group B		
	X Title	Title			Title		
	X	Mean	SD	N	Mean	SD	N
1 Title							
2 Title							
3 Title							
4 Title							
5 Title							
6 Title							
7 Title							

Prism can also plot horizontal X error bars 377. You must enter X error values directly; Prism cannot compute them. You can only enter one value for X errors, so X error bars are always symmetrical.

Entering multiple sets of data that don't share X values

Each data table has a single column for X and up to 104 sets of Y values. What should you do if you have different X values for each set of Y values? There are two ways to solve this problem.

The best approach is to stagger the data entry. You don't have to start entering data in the first row. This example shows three data sets with different X values.

Table format: XY	X	Group A	Group B	Group C	Grou
	X Title	Data Set-A	Data Set-B	Data Set-C	Tit
	X	Y	Y	Y	Y
1 Title	1.0	1			
2 Title	2.0	2			
3 Title	3.0	3			
4 Title	1.1		4		
5 Title	2.1		5		
6 Title	3.1		6		
7 Title	1.2			7	
8 Title	2.2			8	
9 Title	3.3			9	
10 Title					
11 Title					

An alternative approach is to enter each data set on a different table. The disadvantage with this method is that you lose some analysis choices. You must enter all the data sets on one table in order for Prism to

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compare linear regression lines, to compare best-fit values from nonlinear regression, and to compare survival curves. Another minor disadvantage is that Prism will automatically make a different graph for each table. However, you can delete the unneeded graphs and include data from all the data tables on a single graph.

Entering error values for X error bars

If you choose to enter X error values, the table will include a subcolumn for that purpose. You can only enter one error value for each X. Prism doesn't know if it is a SE or SD or something else. It just plots what you enter. You cannot enter two error values to create asymmetric X error bars. The X error values never enter into any calculations.

Table format: XY		X		Group A	
		X Title		Title	
		X	Err. Bar	A:Y1	A:Y2
1	Title				
2	Title				
3	Title				
4	Title				

What happens if you enter X values into the row title column of a Grouped (or XY) table?

Possible point of confusion. A Grouped table has a column for entry of row titles. Prism sees these as titles or labels, even if you enter numbers in every row. The table below if a Grouped table with no X column. Note that there is no heading "X" and that the labels (numbers) entered in that column are left justified (X values would be right justified). Also note that the values are equally spread across the X axis. Prism doesn't "know" these labels are numbers, so doesn't use the value as a X coordinate.

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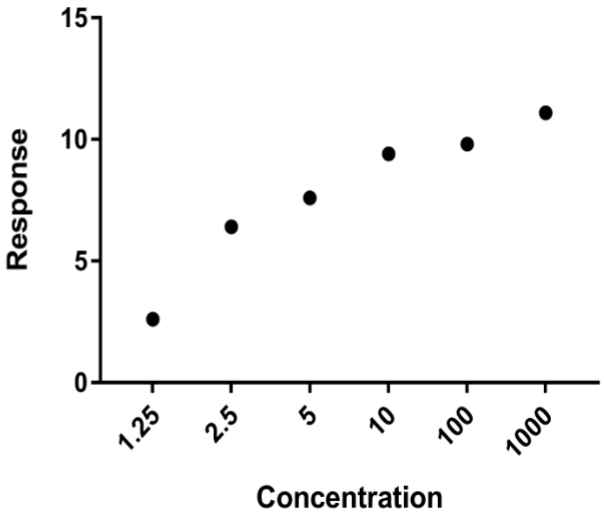
Table format: Grouped		Group A
		Data Set-A
		Y
1	1.25	2.6
2	2.5	6.4
3	5	7.6
4	10	9.4
5	100	9.8
6	1000	11.1



11.1.4 Column tables (one grouping variable)

In a column data table, each column defines a group. These groups are defined by one scheme, perhaps "control vs. treated." You can have more than two groups in a one-way table, for example "placebo vs. low-dose vs. high-dose.

Analyses performed with Column data

- Unpaired t test
- Paired t test
- Ratio-paired t test
- Mann-Whitney test
- Wilcoxon test
- Kolmogorov-Smirnov test
- Ordinary one-way ANOVA
- Brown-Forsythe and Welch ANOVA
- RM one-way ANOVA

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- Kruskal-Wallis test
- Friedman test
- One sample t and Wilcoxon test
- Descriptive Statistics
- Normality and Lognormality Tests
- Frequency Distribution
- ROC Curve
- Bland-Altman
- Identify Outliers
- Analyze a stack of P values

Example of a column table

	Group A	Group B
	Placebo	Active Drug
	Y	Y
1	45	67
2	23	46
3	56	113
4	76	79
5	81	123
6	87	
7	99	

- Each column defines a treatment group.
- Prism does not use a separate column to enter the grouping variable. Instead the groups are defined by columns.

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- If data are not matched or paired, rows have no special meaning. Enter data in any order you like.

- If data are from a before-after experiment with clear pairing or matching, place each set of matched results on one row. Optionally, use the row title to label it.

- Blue italics values are “excluded” (ignored by analyses and graphs). Use Exclude Values.

Error bars

For one-way tables, Prism will calculate error values and create error bars automatically. Enter all the values for a data set in a single column.

Table format: Column	Group A	Group B	Group C	Gro
	Control	Drug A	Drug B	T
	Y	Y	Y	
1	23	31	98	
2	24	61	90	
3	21	31	87	
4		*43**	77	
5	25	56	71	
6	30	34	79	
7				

11.1.5 Grouped tables (two grouping variables)

The idea of grouped variables is best understood by example. One grouping variable might be "male vs. female"; the other grouping variable is "control vs. treated." Every data point you collect is categorized by both grouping variables: "male vs. female," AND "control vs. treated." A two-grouping variable table and graph is used to tabulate outcomes that are measurements such as weight or blood pressure, often with error bars.

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Analyses performed with Grouped data

- Two-way ANOVA (and mixed model)
- Three-way ANOVA (and mixed model)
- Row means with SD or SEM
- Multiple t tests - one per row

Example of a grouped table

Table format: Grouped		Group A			Group B		
		Control			Treated		
		A:Y1	A:Y2	A:Y3	B:Y1	B:Y2	B:Y3
1	Men	34.5	32.9	43.3	87.5	*321.5**	81.7
2	Women	42.3		45.9	109.4	111.2	115.4

Notes:

- Unlike other programs, Prism does not use separate columns to enter grouping variables. Instead, groups are defined by rows and columns.
- The rows categorize the data by one grouping variable (men vs. women).
- The columns (datasets) categorize the data by the other grouping variable (control vs. treated).
- Blank cells represent missing values, which Prism handles properly. If you are doing repeated-measures ANOVA, however, you can't have any missing data values unless an entire subcolumn is empty.
- Blue italics values are “excluded” (ignored by analyses and graphs). Use Edit… Exclude values.
- A grouped data table can contain 256 data set columns and as many as 256 sub-columns

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Error bars

Prism will compute and graph error bars from replicate values placed in side by side subcolumns as shown (duplicate values) in the table above. Specify the number of subcolumns when you create a new table.

You can also choose to create subcolumns formatted for entry of error values computed elsewhere.

Table format: Grouped	Group A			Group B		
	Title			Title		
	Mean	SD	N	Mean	SD	N
1 Title						
2 Title						

11.1.6 Contingency tables

What is a contingency table?

Contingency tables are used to tabulate the actual number of subjects (or observations) that fall into the categories defined by the rows and columns of a table.

The rows and columns can be defined in different ways, based on experimental design.

- Prospective: You choose subjects based on exposure, from which you define the rows. Each column represents a different outcome.
- Retrospective (case-control): Each column represents a different group of subjects, identified based on presence or absence of disease. Each row represents a different exposure they have had in the past.
- Experiment: Each row represents a different treatment group. Each column represents a different outcome.
- Cross-sectional: You select a group of subjects, and then categorize them by exposure (different rows) and disease (different columns).

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Analyses performed from a contingency table

- Chi-square and Fisher's exact test (also computes odds ratios and relative risk)
- Fraction of total

Example of a contingency table

Table format: Contingency		Outcome A	Outcome B
		Graft Patient	Graft Obstructed
		Y	Y
1	Standard Treatment	45	5
2	Experimental Treatment	49	1

The rows represent two different treatments. The two columns represent two alternative outcomes. Each value is the actual number of subjects (in this case; in other cases, the values may represent number of objects or events).

It is essential that you enter the actual number of subjects (objects, events...) that you counted. Do not enter normalized values or percentages. Since the values are counts, they cannot be negative and must be integers. Prism won't let you enter a minus sign or decimal point or create subcolumns. If you need to enter fractions or negative numbers, or create a table with subcolumns, use a Grouped table 212 instead.

11.1.7 Stacked vs. side-by-side replicates

Note that replicates are arranged differently on different kinds of data tables.

- With XY and Grouped tables, replicates are entered into side-by-side subcolumns.

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- With Column tables, replicates are stacked into columns.
- With Nested tables, replicates are stacked into subcolumns.
- When entering data on Contingency, Parts-of-whole, Survival and Multiple Variable tables, you never enter replicate values so this distinction is irrelevant.

11.1.8 Survival tables

On a survival table, you enter information for each subject. Prism then computes percent survival at each time, and plots a Kaplan-Meier survival plot (and also compares survival with the log-rank and Gehan-Wilcoxon tests).

Analyses performed with survival data

There is one survival analysis in Prism that gives you choices for any of these analyses:

- Kaplan-Meier
- Log-rank test
- Wilcoxon-Gehan test

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Example of a survival table

		X	Group A	Group B
		Days elapsed	Control	Treated
		X	Y	Y
1	Title	46	1	
2	Title	46	0	
3	Title	64	0	
4	Title	78	1	
5	Title	124	1	
6	Title	130	0	
7	Title	150	0	
8	Title	150	0	
9	Title	9		1
10	Title	26		1
11	Title	43		0
12	Title	46		1
13	Title	64		1
14	Title	75		1
15	Title	100		1
16	Title	130		0
17	Title	150		0

Each row represents a distinct subject. (You can optionally use row titles to identify the subjects.) Each column represents a treatment.

Notes:

- Enter elapsed time (usually in days) as X (Prism does not let you enter dates).
- For each subject, enter a code for Y:
- Enter '1' for a subject if the event (death) occurred at the time entered into X.
- Enter '0' if the data are censored. Data are censored when you simply don't know what happened to the subject after that time, or do know but can't use the information.

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- You'll find a more complete discussion of entering survival data and interpreting the results in the statistics guide.

Error bars

When Prism plots a survival curve, it can include SE or 95% CI error bars. These are computed as part of the Kaplan-Meier method for creating the survival curve. You can't enter error values directly -- they are computed from all the data.

11.1.9 Parts of whole tables

A Parts of whole table is used when it makes sense to ask: What fraction of the total is each value? This table is often used to make a pie chart.

Analyses performed on parts of whole data

- Fraction of total
- Chi-square goodness of fit (compare observed distribution with theoretical distribution)

Example of a Parts of whole table

The example below shows the number of students who received grades of A, B, C, etc. The sum of the five values in the table (61) is the total number of students.

Table format: Parts of whole		A
		Number of Students
		Y
1	A	23
2	B	29
3	C	7
4	D	2
5	E	0

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You can enter data onto as many columns as you want. But note that only the values entered into column A will be automatically graphed. Use New...Graph to plot other columns.

11.1.10 Multiple variable tables

A multiple variable table is arranged the same way most statistics programs organize data. Each row is a "case" (experiment, animal, etc.). Each column is a different variable. There are no subcolumns in multiple variable tables.

Analyses performed on parts of whole data

- Correlation matrix
- Multiple linear regression
- Extract and rearrange portions of the data onto a new table
- Transform and select
- Identify outliers
- Descriptive statistics

Example of a Parts of whole table

The example below shows the first few rows of data from a clinical trial about diabetes. Each row represents one person studied. Each column is a different variable measured.

		Variable A	Variable B	Variable C	Variable D	Variable E	Variable F	Variable G	Variable H	Variable I	Variable J
		Glycosylated hemoglobin %	Total cholesterol	Glucose	HDL	Age in years	Male?	Height in inches	Weight in pounds	Waist in inches	Hip in inches
		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
1	Title	4.309999943	203	82	56	46	0	62	121	29	38
2	Title	4.440000057	165	97	24	29	0	64	218	46	48
3	Title	4.639999866	228	92	37	58	0	61	256	49	57
4	Title	4.630000114	78	93	12	67	1	67	119	33	38
5	Title	7.719999790	249	90	28	64	1	68	183	44	41

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Prism does not automatically graph these kinds of tables, because there is too much data.

Prism requires that you enter numbers only. If one column encodes sex, you must enter codes (say 0 for female and 1 for male). You can't enter "male" or "female" directly on a Prism table.

.

11.1.11 Nested tables

Overview of nested tables

Prism 8 introduces a new kind of data table for nested data where values stacked in each subcolumn are related, and lets you graph these sensibly. In this example, there are two treatments given to three rats each and the outcome variable was measured four times in each rat.

Analyses performed from nested tables

- Nested t test
- Nested one-way ANOVA
- Descriptive statistics (separate results for each subcolumn)
- Normality (and lognormality) tests (separate results for each subcolumn)>
- Outlier tests (separate results for each subcolumn)
- One-sample t test (separate results for each subcolumn)

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Example of a nested table

	Group A			Group B		
	Teaching method A			Teaching method B		
	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6
1	21	18	35	26	38	31
2	26	25	28	34	44	41
3	33	26	32	27	34	34
4	22	24	36		45	35
5		21	38		38	38
6		25				46
7						

Each nested table must have at least two subcolumns. It is not possible to enter averaged data (mean, sd, n...). Error bars on graphs are computed from a stack of values in the same subcolumn.

11.1.12 The difference between nested and grouped tables

Nested 220 and Grouped 212 tables look very similar. Both have subcolumns and no X column. But they are used in very different ways.

The key point is the arrangement of replicates:

- In a Grouped table, replicates are placed in side by side subcolumns.
- In a Nested table, replicates are stacked into subcolumns.

We suggest you use the tutorial data sets and pay attention to how the data arrangement matches the experimental design.

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11.2 Creating data tables

How to create data tables.

11.2.1 How to create a new data table

A Prism project 113 can contain many data tables.There are three ways to create a new table

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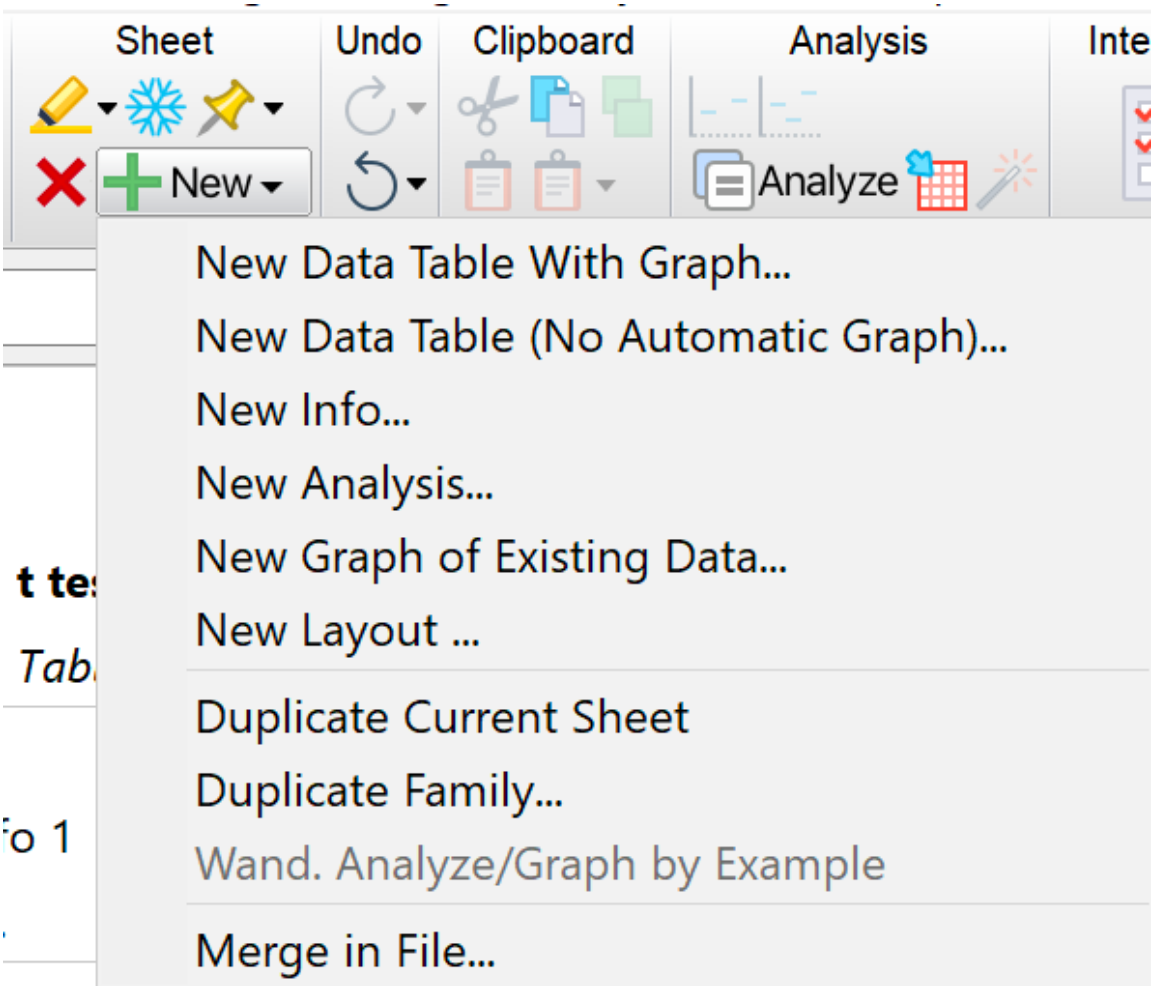
New button

Click the new button from the Sheet section of the Prism toolbar (or drop the Insert menu) and choose New Data Table and Graph.



The New Data Table and Graph dialog looks a lot like the Welcome (File..New) dialog (with fewer choices). Choose which of seven kinds of data tables 201 you want, and whether to start with an empty table or use sample data. If you choose to create an XY or Grouped table and are not using sample data, you'll also need to decide about subcolumn format.

From the navigator

New to Prism 8, click a link in the navigator to create a new sheet.

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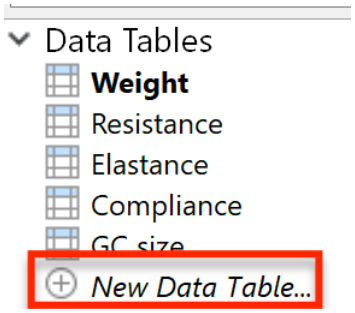
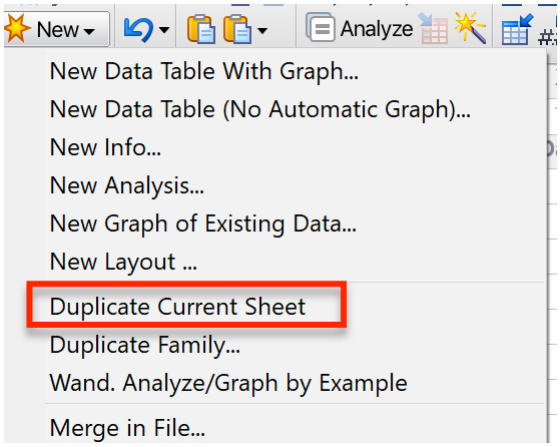


Duplicate an existing table

To duplicate an existing table, to to that table, drop the Insert menu or click the New button and choose Duplicate Current Sheet



11.2.2 Creating a table to create a bar graph

Prism offers eight distinct types of data tables. Five of these can be used to create bar graphs, as detailed below. If you want to create a bar graph, it is important to choose the kind of data table that matches your data.

Column graphs

Enter data for each group into its own column, stacking replicates (if any). Each column then becomes a bar, and you'll be able to control the appearance of each bar individually.

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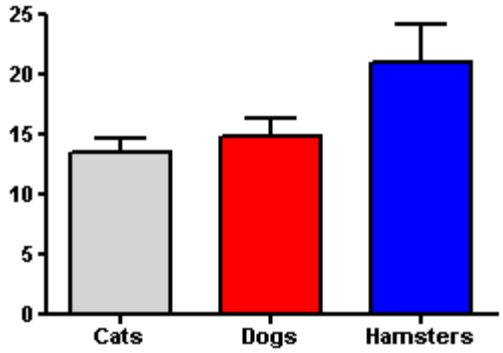
	Group A	Group B	Group C	Grou
	Cats	Dogs	Mice	Tit
	Y	Y	Y	Y
1	12	13	22	
2	11	12	12	
3	15	15	24	
4	16	19	26	
5				
6				
7				



Note: If you want to create a graph like the one above, but you've already calculated your mean and error values, start instead with a Grouped table (see below) and use only the top row.

Table format: Grouped	Group A			Group B		
	Title			Title		
	Mean	SD	N	Mean	SD	N
1 Title						

Grouped graphs

Each column represents a different kind of bar. Each row is a different instance of that bar. Enter replicates (if any) in side-by-side subcolumns, or format the subcolumns for entry of mean, n and SD or SEM. So if you have two Y data set columns and four rows, you will have two kinds of bars, and you can choose the color, fill, and border of each. You will have four different bars of each type. You can choose whether you want the bars interleaved, stacked, or separated.

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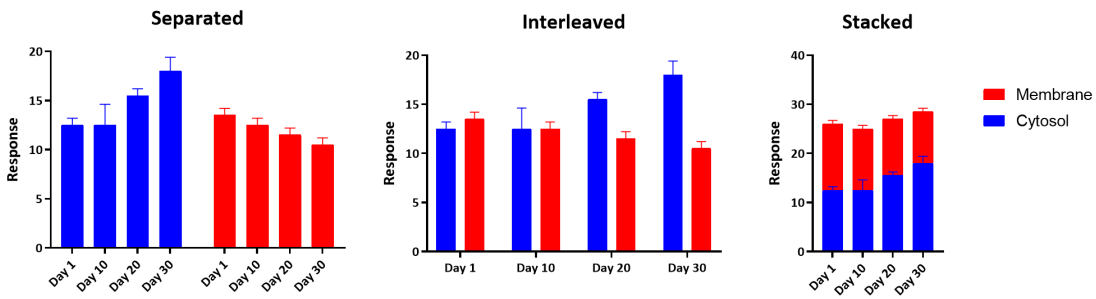
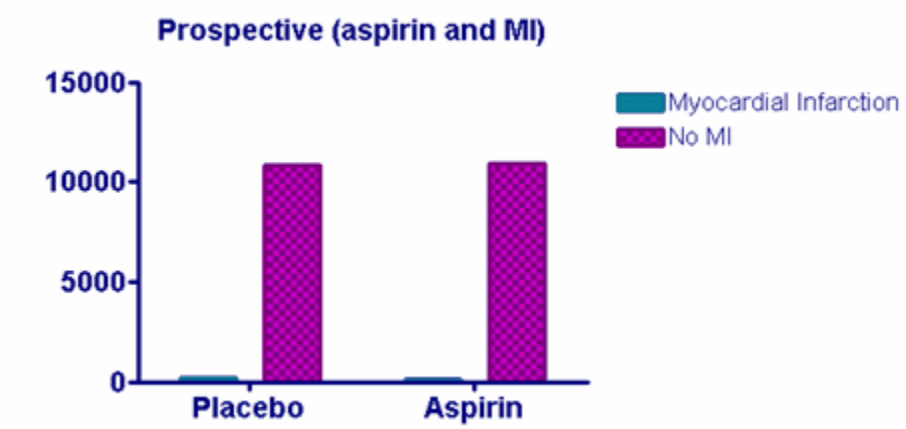
Table format: Grouped		Group A		Group B	
		Cytosol		Membrane	
		A:1	A:2	B:1	B:2
1	Day 1	12	13	14	13
2	Day 10	11	14	13	12
3	Day 20	15	16	11	12
4	Day 30	19	17	10	11



Contingency tables

A contingency table is like a grouped table but doesn't have subcolumns for replicate values.

Table format: Contingency		Outcome A	Outcome B	Outc
		Mycardial Infarction	No MI	T
		Y	Y	
1	PLacebo	189	10845	
2	Aspirin	104	10933	
3	Title			



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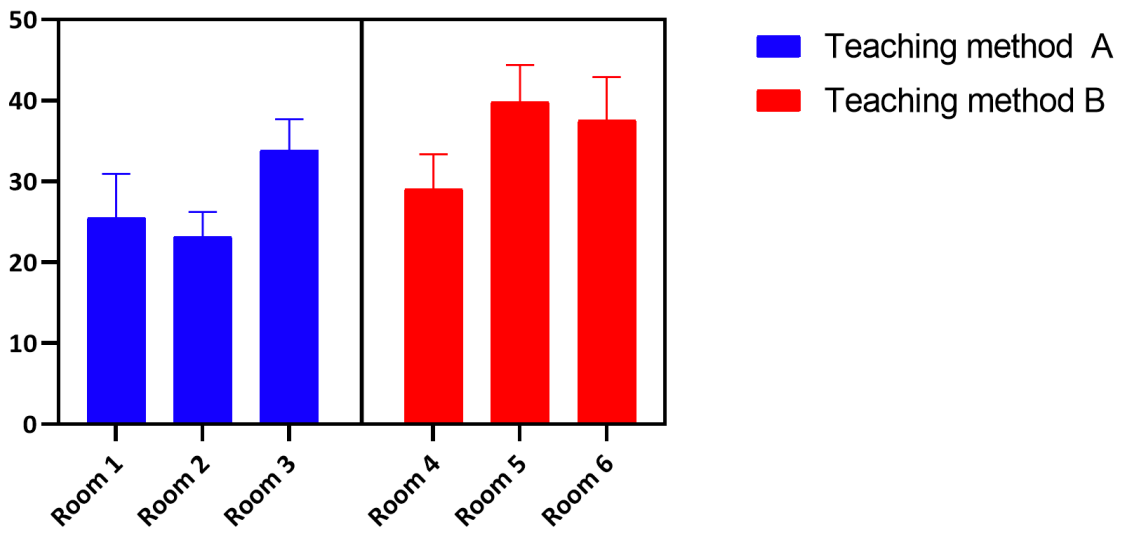
Nested bar graphs

	Group A			Group B		
	Teaching method A			Teaching method B		
	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6
1	21	18	35	26	38	31
2	26	25	28	34	44	41
3	33	26	32	27	34	34
4	22	24	36		45	35
5		21	38		38	38
6		25				46
7						

Each subcolumn becomes a bar, shown here with mean and SD.



XY Bar graphs

Both the kinds of bar graphs mentioned above place the bars on the graph in order, with equal spacing. In some cases, you want to position each bar along the X axis with the position determined by an X coordinate you enter. To make this graph, choose the Spikes graph in the New Graph dialog.

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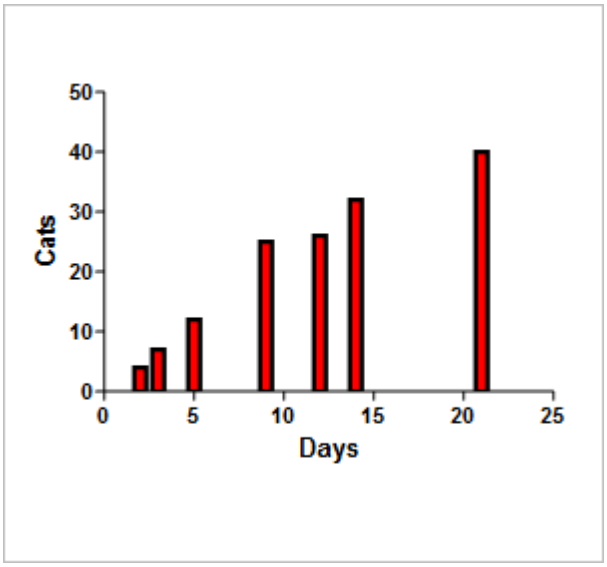
Table format: XY		X	Group A	Gr
		Days	Cats	
		X	Y	
238	Title	2	4	
239	Title	3	7	
240	Title	5	12	
241	Title	9	25	
242	Title	12	26	
243	Title	14	32	
244	Title	21	40	



Settings in the Format Graph dialog also let you make this graph. Uncheck the option to "Show Symbols" and check the option to "Show bars/spikes."

11.2.3 Creating a table to create a scatter plot

Prism offers seven distinct types of data tables. Three of these can be used to create scatter graphs.

XY scatter graphs

With an XY data 206 table, each X value can have several replicates for every data set. When you make your graph, you can choose to show all the replicates on your graph instead of error bars. Start with an XY table if you want to show all your replicates for each X value.

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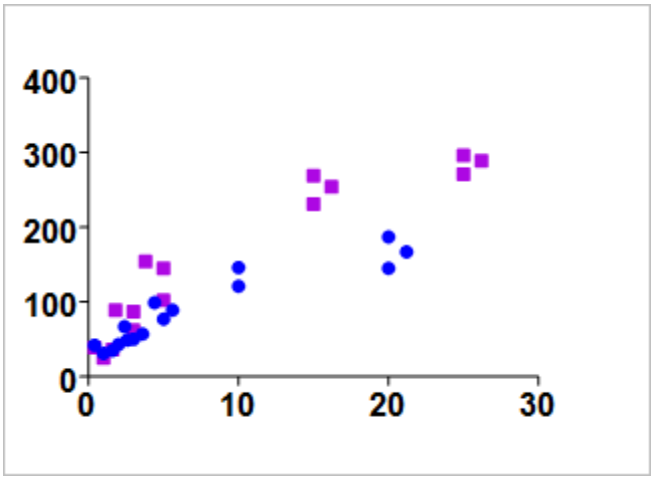
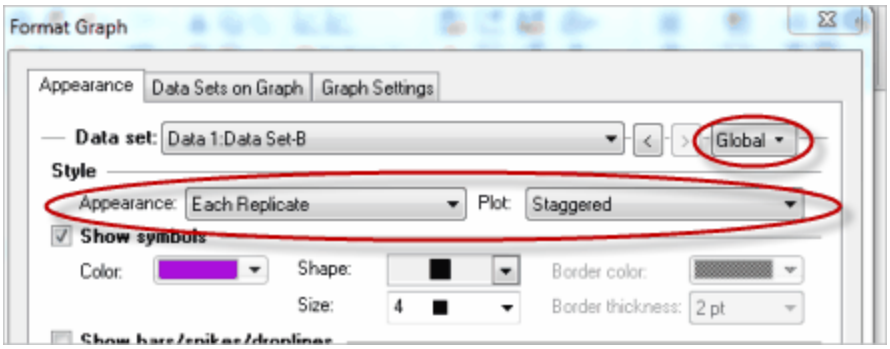


Here is the data table for the graph above.

Table format: XY	X	Group A			Group B		
	X Title	Data Set-A			Data Set-B		
	X	A:Y1	A:Y2	A:Y3	B:Y1	B:Y2	B:Y3
1 Title	1	35	31	42	36	39	25
2 Title	2	43	49				
3 Title	3	50	57	67	87	89	62
4 Title	4						
5 Title	5	77	89	99	102	145	154
6 Title	10	146		121			
7 Title	15				254	269	231
8 Title	20	167	187	145			
9 Title	25				289	296	271
10 Title							

To format an XY graph to show each data point as in the graph above, click on the Format Graph button on the toolbar, select Global to choose all data sets, and choose to Show each Replicate. To show mean and error instead, choose Mean and Error from this drop-down menu instead.



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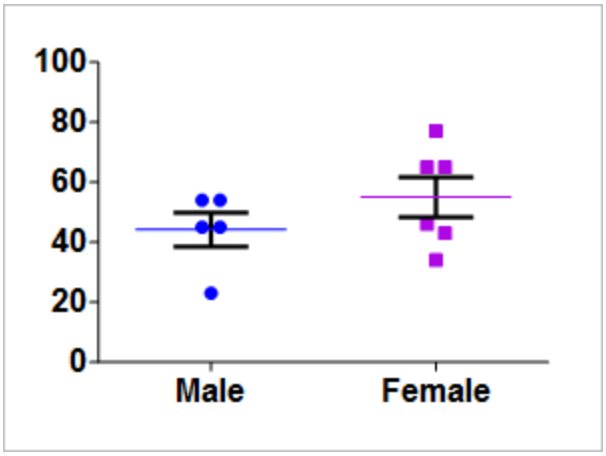
Column scatter graphs

If you want to compare groups and show every data point along with lines for mean and error for each group, start with a column table. All the data values for each group should be entered in a single column.



To make the graph above, start with a Column table 210 and enter all the data points for each data set in a column. Prism will create error bars from all the data points in each column.

	Group A	Group B
	Male	Female
	Y	Y
1	54	43
2	23	34
3	45	65
4	54	77
5	45	46
6		65
7		

If you instead want a graph that shows only the mean and error for each data set, double click on any data point to open the Format Graph dialog and choose "One symbol per column" and the type of error you want to show.

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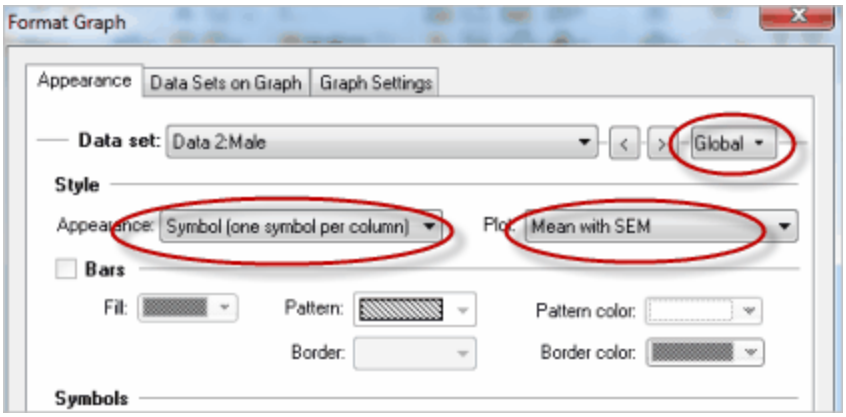
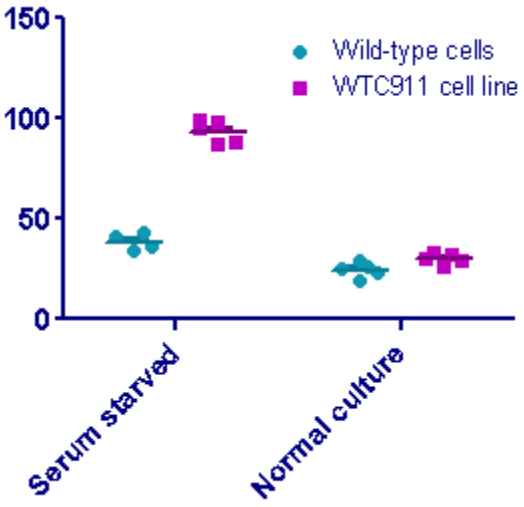


Grouped scatter graphs

If you want to create a scatter plot comparing groups by more than one variable, enter data on a Grouped data table with side by side replicates.

Table format: Grouped		Group A				Group B				
		Wild type cells				WTC91 cell line				
		A:Y2	A:Y3	A:Y4	A:Y5	B:Y1	B:Y2	B:Y3	B:Y4	B:Y5
1	Serum starved	36	41		43	98	87	95	99	88
2	Normal culture	19	26	29	25	32	29	26	33	30

Here are the data plotted as an interleaved graph:



You can also choose to superimpose the groups:

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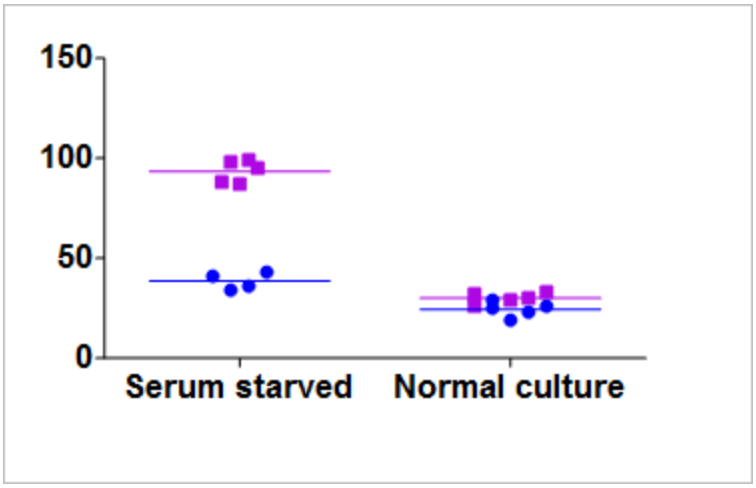

11.2.4 Creating a table to combine bars and points

Prism offers three ways to create graphs that combine points and bars.

XY

Create an XY graph and then tell Prism to plot a data set (or several) as spikes or bars. Detailed instructions to create the graph below.

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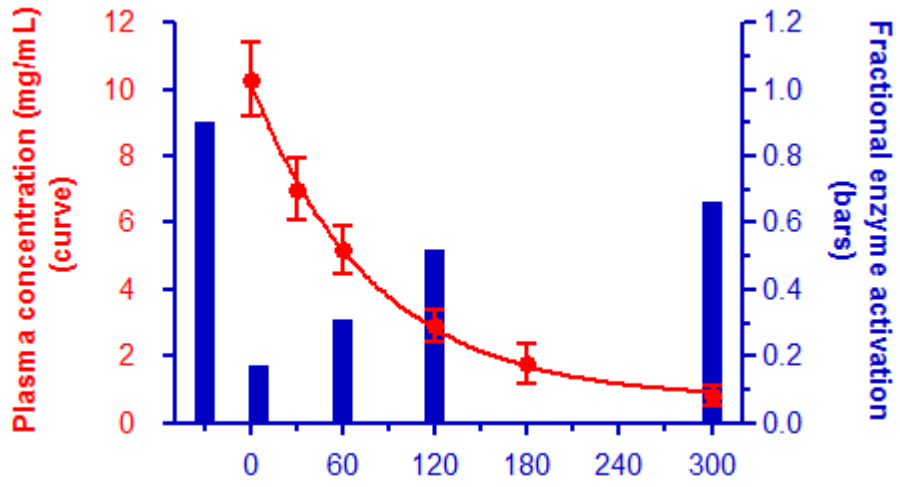
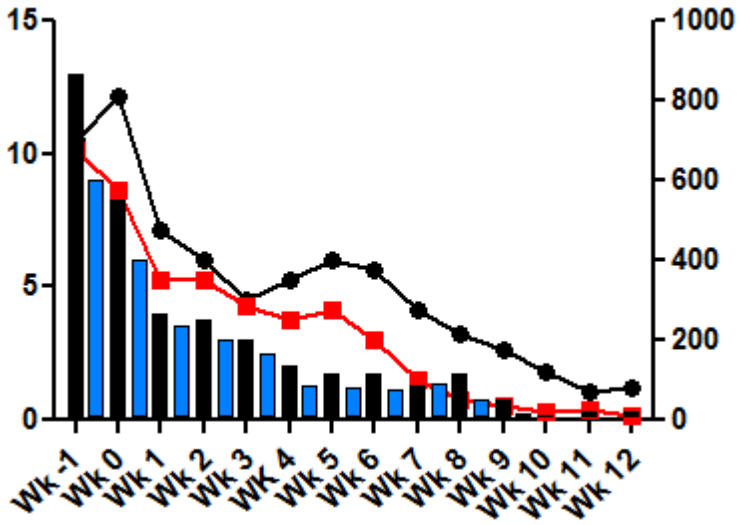


Grouped

Create a grouped bar graph, then tell Prism to plot one data set (or several) as points. Detailed instructions for creating the graph below.



Create two graphs and superimpose them on a layout

A third approach to getting bars and points on what appears to be one graph is to create one XY graph and one column graph, and then tell Prism to superimpose them on a page layout. Detailed instructions to create the graph below.

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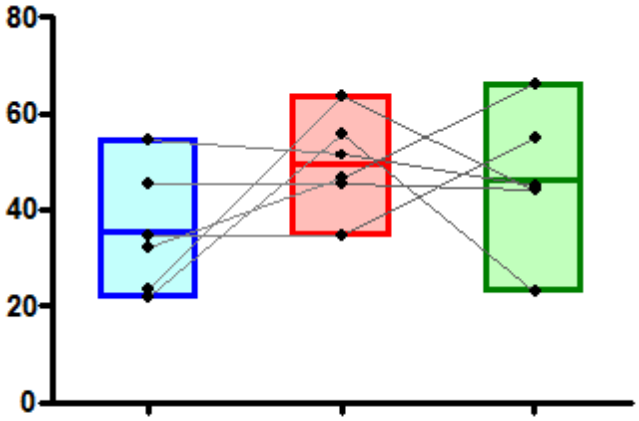


11.2.5 Inserting a series

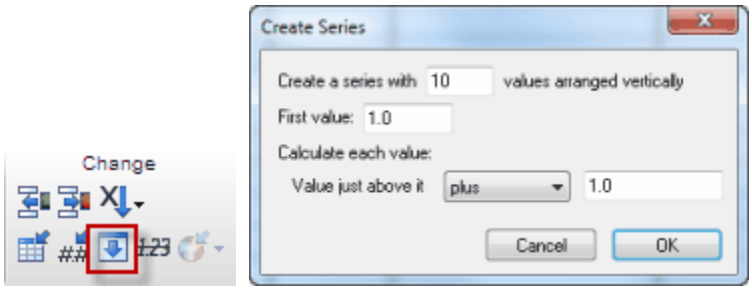
Often you'll want your X column of an XY table to be a regular series of values. Prism offers two ways to do this.

Using the Insert Series command

Follow these steps to insert an arithmetic or geometric series:

1. Place your insertion point in the first cell of the series. Alternatively select the entire range that you want to contain the series.

2. Drop the Insert menu and choose Create Series... Or click the corresponding button in the Change portion of the toolbar.



3. Enter the number of values you intend the series to have. If you preselected a range of values, Prism will default to the number of rows in that range. Also enter the first value, and the rule to increment other values.

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Notes:

- You'll usually want to create a series in the X column of any XY table, but you can insert a series in any column of any table.
- If you select an entire column before bringing up this dialog, the dialog will default to creating a series with 500,000 values. This can take a while. Adjust the value a reasonable number.

Turn the X column into a series

This option is a carryover from prior versions of Prism, and we suggest you use the Insert Series command instead.

To turn the X column into a series:

1. Create a new XY table.
2. Enter at least one Y value or column titles so the table is not completely empty.
3. Click the Table Format button at the upper left of the table, or drop Change and choose Format Data Table.
4. Choose to generate X values, and enter the starting value and increment.

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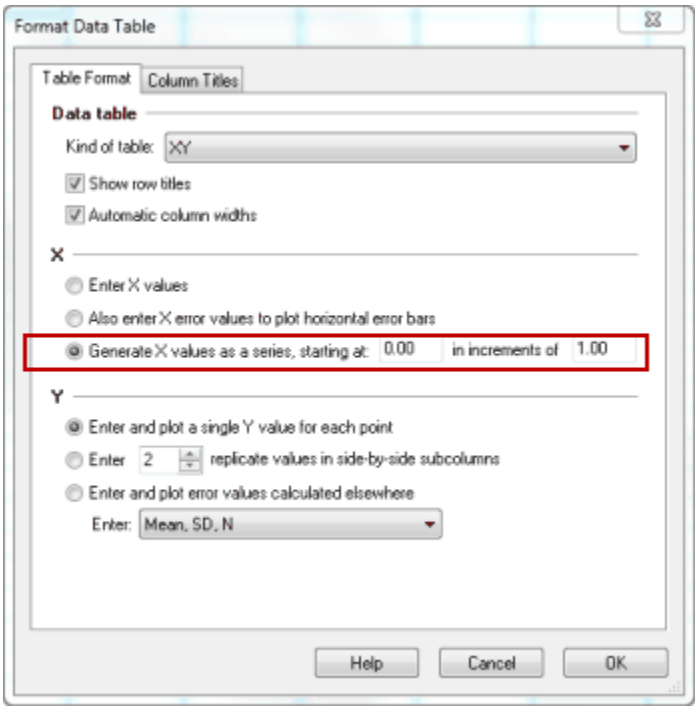

Notes:

- On older versions of Prism, you were able to define this series at the time you created the table. With Prism 6, you can no longer do this. You must first create the table, and then use Format Data Table to define the series.

- When you define the X axis to be a series, Prism will delete any X value you had entered into the X column without asking for confirmation.

- With this method, the entire X column becomes a nearly infinite series. You cannot tell Prism where to stop the series.

- With this method, the series is always arithmetic -- each value is computed by adding a constant increment to the prior one. Use the Insert Series dialog to create a geometrical series — each value is computed by multiplying a constant factor times the prior one.

11.2.6 Data table limits

You can have up to 500 data tables in your project. Each data table can contain:

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- Any number of rows (limited by RAM and hard disk space). We've tested hundreds of thousands of rows.
- Up to 256 data set columns. Prism 5 only allowed 104.
- Up to 256 subcolumns. Prism 5 only allowed 52.

If your table has more columns or subcolumns that Prism 5 can handle, the table will simply not be included when you open the file in Prism 5.

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11.3 Editing data tables

How to edit data tables.

11.3.1 Changing a data table format

The choice you make about how to format your data table is important. If you don't choose the appropriate kind of data table, you won't be able to make the kind of graph you want or perform the analyses you have in mind.

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For XY tables Prism uses subcolumns replicate data. If your table needs more subcolumns you can always change the number of subcolumns (replicates) in a data table. Or, if you entered already-calculated error values but your table is labeled wrong (say you actually entered SD, but the table is formatted for SEM, you can make the switch.

To change the format of a data table, Click on the Table format area in the upper left of a data table.

Table format: XY		X	Group A
		conc (pM)	Binding (fmol/mg)
		X	Y
1	Title	6	100
2	Title	17	250
3	Title	29	260
4	Title	40	360
5	Title	50	350
6	Title	60	400
7	Title	72	403
8	Title	82	425
9	Title	92	430
10	Title	103	442
11	Title	115	455
12	Title	125	450

Alternatively, click on the Table Format button on the Change toolbar.

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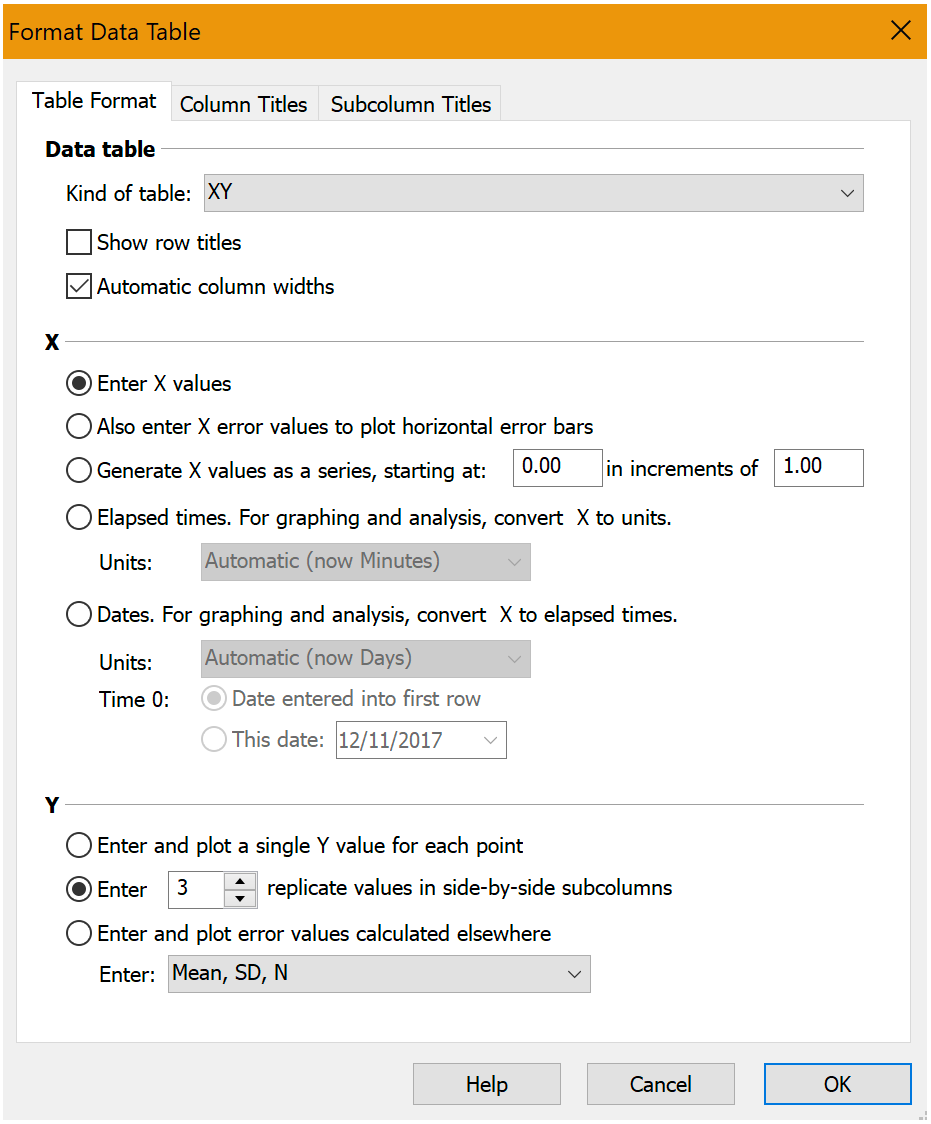

If you want to change the type of error bars displayed on your graph, you don't need to change the data table. Instead, double-click on any data point on your graph to open the Format Graph 399 dialog and use the drop-down menu to change the error-bar format.

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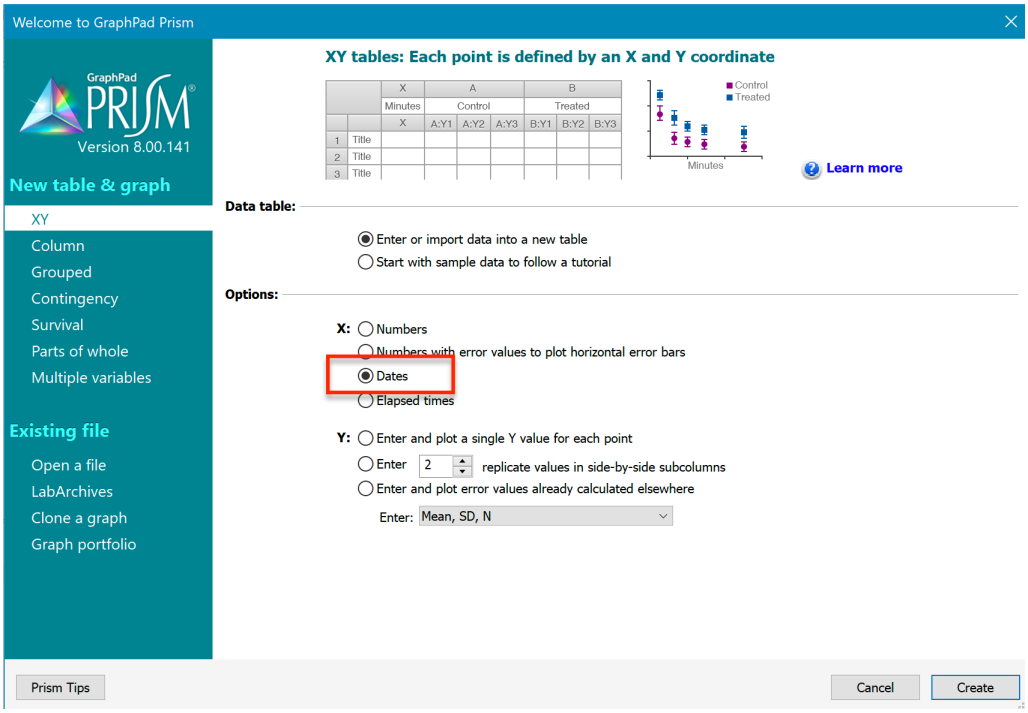
11.3.2 Entering dates or elapsed times as X

Formatting the table to enter dates or times as X values

From the Welcome or New Table dialogs, you can choose to format the X column for entry of dates or elapsed time instead of X values.



If you forgot to format the table when you created it, use Change..Format data table to format the X values for dates or times.

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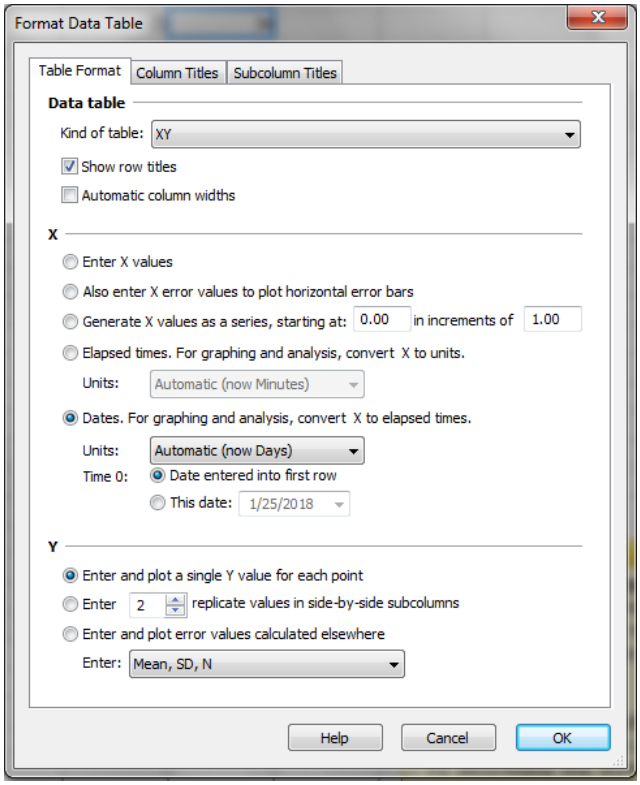
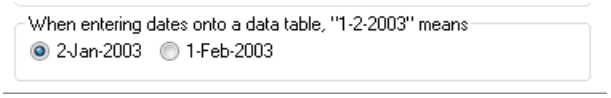


Entering times or dates

If you choose elapsed time, enter time as hh:mm or hh:mm:ss. For example, enter 1:12:30.2 to enter an elapsed time of 1 hour, 12 minutes, 30.2 seconds.

If you chose to enter dates, you can enter dates in almost any format. Prism will figure out what you meant and display the date on the table in a standard format (that you cannot change). The only ambiguity is if you enter a date like 1/2/2014 or 1-2-2014. Is that January 2 or February 1? The convention depends on where in the world you live. Make your choice on the bottom of the View tab of the Preference dialog.



If you enter a year with two digits, Prism Windows follows the choices made in the Date tab of the Additional Settings dialog, accessed from the Format Tab of the Regional settings control panel.

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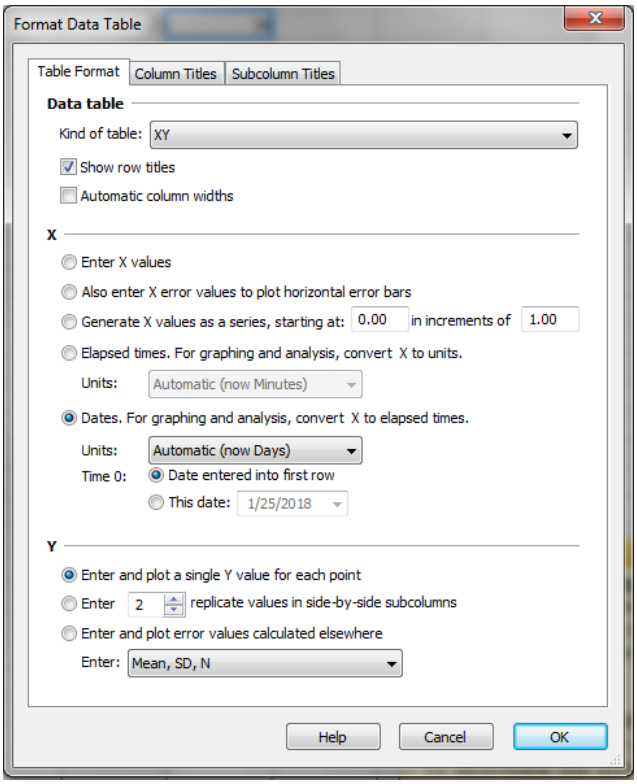
When Prism shows a ? in the data table

If Prism doesn't understand the date or time you entered, it will show ? in the data table. This is treated as a missing or blank value for graphing and analyses. When you click on the cell to edit, Prism will show you exactly what you entered for editing.

Converting dates or times to values for analyses

When you analyze these data and make some kinds of graph, Prism converts the dates or elapsed times to values. Choose the units and (for dates) starting date on the Format Data Table dialog 238. Note that the choice of months is not offered, because months have different lengths. Years also have different lengths, so if you choose years, Prism does the conversion based on 365.25 days per year.



Formatting dates and times on the graph

The Format Axes dialog will present several choices for numbering format.

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11.3.3 Column titles

Why use column titles?

Column titles are used to:

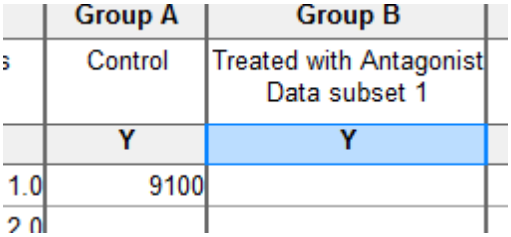
- Identify data sets on a data table.
- Identify data sets when choosing analyses and viewing results.
- Labeling the X axis of Column (and sometimes) grouped graphs.
- Creating legends for XY and Grouped graphs.

How to edit column titles

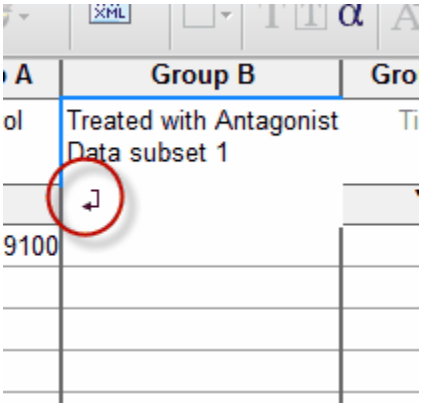
Click on the column title and edit. You can bold, italicize, and underline text in titles and can insert superscripts, subscripts and Greek letters.

Enter two or three line row titles and column titles

You may enter two or more lines of text for each column title.



To add an additional line of text to the title click the Line Break symbol or press the key combination Shift-Enter to move to the next line.



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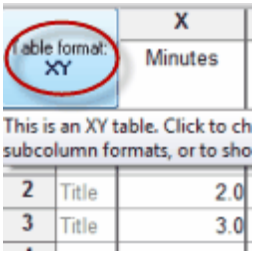
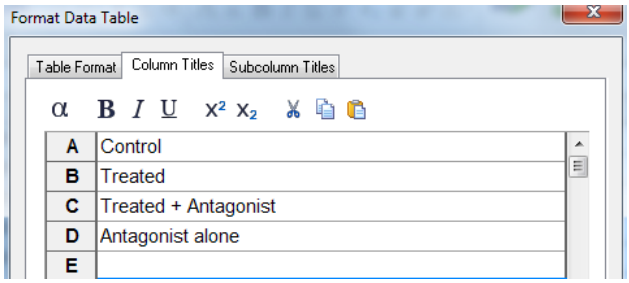
View and edit all the column titles at once

To view and edit multiple column titles at once, click on the Format Data table button in the upper left corner of the data table and choose the tab for column titles. If your table has many subcolumns, this is the best way to edit column titles. Shortcut: Bring up this dialog by double-clicking in a one of the column titles on the data table.





Autocomplete

Prism uses autocomplete to help you. It tries to guess what you are typing, and let's you choose from a list of titles you've used before. If you find this more annoying than helpful, turn it off in the View tab of the Preferences dialog.

To see the full list of autocomplete entries, while your insertion point is in a column title, hold Alt (Windows) or Option (Mac)and then press Page Down. Next to each entry is a X icon that let's you delete that title from the list.

11.3.4 Subcolumn titles

XY and Grouped tables can be formatted to have side-by-side subcolumns. These subcolumns can be created to hold preaveraged data,

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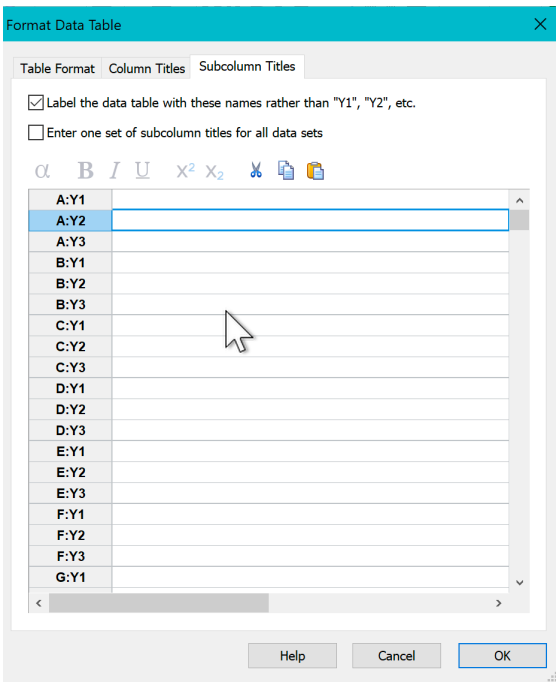
perhaps entering mean, SD and n. In these cases, the subcolumns are labeled. In other cases, you create side by side subcolumns for entry of replicate values. By default these are labeled "Y1", "Y2", etc.

Prism lets you you change these labels. Use Change... Format data table and go to the third tab. You'll see the subcolumn tab of the Format Data Table dialog.

Shortcut: Double click on any subcolumn tiltle (A:Y1 or B:Y2..).



If you check the option on top of the dialog, the titles you enter will appear on the data table.

Table format: XY		X	Group A			Group B		
		Minutes	Control			Treated		
		X	A646	A345	A445	A786	A234	A984
1	Title	1.0	34	29	28	31	29	44
2	Title	2.0	38	49	53	61		89

Notes:

- Choose between entering one title for every subcolumn for every data set column (as above) or just a single set of subcolumn titles that apply to all data sets. If you chose the latter choice with the example above,

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you'd enter only three subcolumn titles and these would be repeated for each data set.

- Controls are provided in the toolbar of the dialog to enter greek letters and math symbols (etc.) and to enter super and subscripts.

- If the titles you enter are very long, you may wish to uncheck the top option. This will leave the table labels as "Y1", "Y2", etc.

11.3.5 Row titles

Why use row titles?

Row titles have four purposes:

- Label unknowns in standard curves -- the labels will propagate through to the standard curve (interpolated values) results.

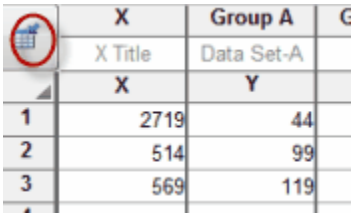
- Label individual points on an XY graph.

- Label groups in a grouped data table.

- Label subjects on a column table plotted as a before-and-after graph.

Show or hide the row title column

If you don't see a column for row titles, click on the Table format area in the upper left of a data table to open the Format table dialog. Choose to "Show row titles."



	X	Group A
	X Title	Data Set-A
	X	Y
1	2719	44
2	514	99
3	569	119

To hide the row title column, click the X at the top of the Row title column.

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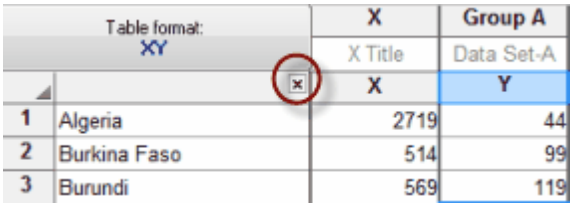
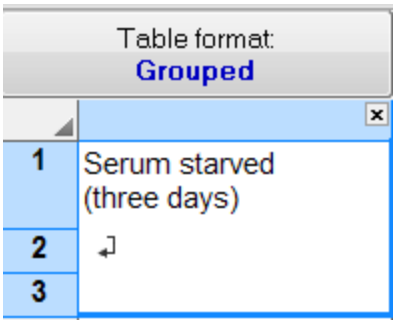


Enter two or three line row titles and column titles

You may enter two or more lines of text for each row title. This is new to Prism 6. You may also now bold, italicize and underline text in titles (you could always use superscript, subscripts and Greek).

To add an additional line of text to the title click the Line Break symbol or press the key combination Shift-Enter to move to the next line.



Autocomplete

Prism uses autocomplete to help you. It tries to guess what you are typing, and let's you choose from a list of titles you've used before. If you find this more annoying than helpful, turn it off in the View tab of the Preferences dialog.

To see the full list of autocomplete entries, while your insertion point is in a row title, hold Alt (Windows) or Option (Mac)and then press Page Down. Next to each entry is a X icon that let's you delete that title from the list.

Showing row titles on a graph

Double click on any symbol to open the Format Graph dialog and choose "Label each point with its row title". Double click on any row label to change the font of all the labels. You can also delete individual labels or drag them to a new location.

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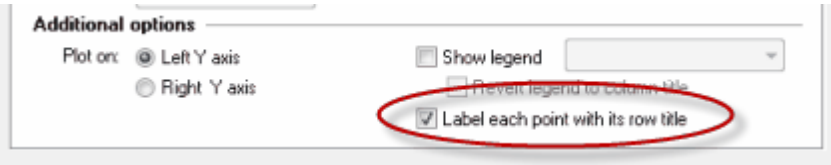

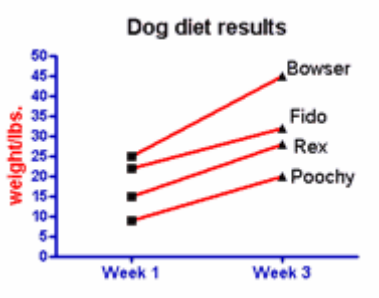

11.3.6 Sorting data

Reordering XY data

If you choose connecting lines on an XY graph, Prism connects the points in the order they appear on the data table. If the data are not sorted on the data table, the connecting lines will jump back and forth across the graph. If you want the connecting lines to go from left to right across the graph, first sort the data table by X values. Click on the Sort Rows button on the Change toolbar, and sort by X value.

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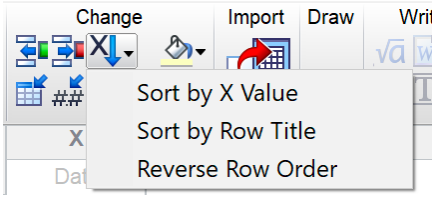
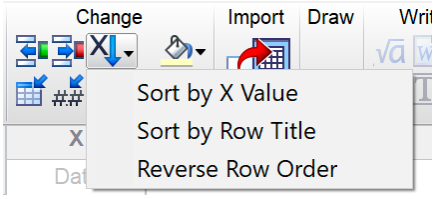


Reordering Grouped data

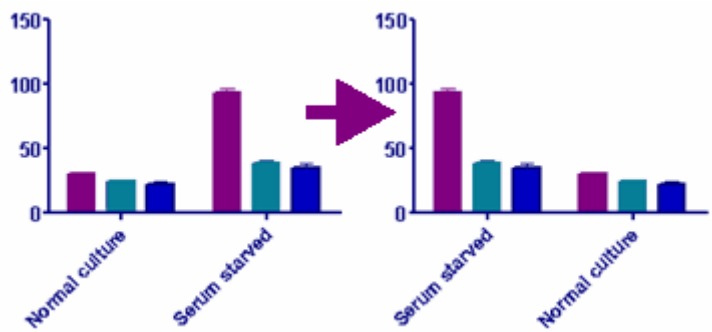
Distinguish two ways to reverse order on a Grouped graph.

Reverse the order of rows

Click on the Sort Rows button on the Change toolbar, and reverse the order.

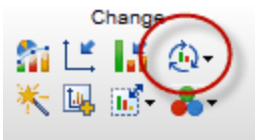


This example shows the effect of reversing the order of the rows in the data table.



Reverse the plotting order of data set columns

Grouped tables are defined by two grouping variables. If you want to reverse the order of how the columns are graphed, you don't need to change the data table. Instead, go to the graph and click the Change data set order button. One of the choices on its menu reverses the order of data sets.



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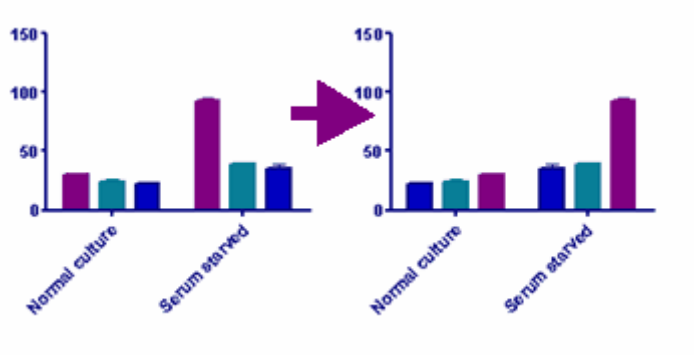
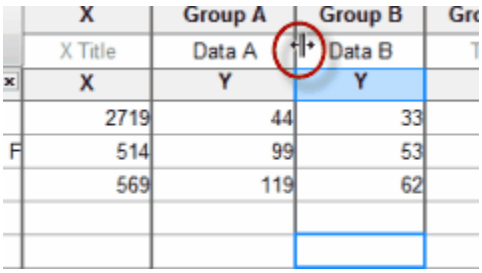
This example shows the effect of reversing the plotting order of data sets. Note that this example starts with the same graph as the prior example.



11.3.7 Changing data table column widths

To adjust the width of a column, click anywhere on a column border and drag. If you first select several columns, dragging the border of one column will change the width of all selected columns. Prism determines the width of subcolumns (replicates) automatically, and you cannot change these widths individually. To make all larger or smaller, resize the main column.



11.3.8 Specifying decimal places in a data table

Decimal format

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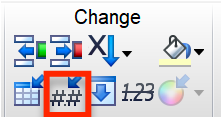
Prism automatically chooses the number of decimal points to display in a data table automatically.

To change the number of decimal points displayed, Select the column or columns you wish to change (click at the top of the column to highlight), and click on the Change decimal format button of the Change toolbar.



Notes:

- When you place the insertion point (click the mouse cursor) in a particular cell in a data table, Prism expands that value to show all digits. When you move to another cell, the value reverts back to the selected numerical format.
- It is not possible to change decimal format of a contingency table or the Y values in survival tables, since all values must be integers.
- You can only change numerical format for an entire column (or several columns). It is not possible to change the numerical format of individual cells.

Decimal separator

In some parts of the world, a period (point) is used as the decimal separator. In other parts of the world, a comma is used.

When entering data into Prism, you can use either a period or a comma to mark the decimal point.

When exporting data, Prism uses the separator you choose in the Export dialog. When pasting data, Prism uses the separator set in Preferences 191.

When importing data 278, you can specify how a comma is interpreted (as a decimal separator, as a thousands separator, or to separate columns of data).

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Changing the number of decimals shown vs. the number Prism stores

Using the Decimal Format dialog simply changes the number of digits that Prism displays on the screen. It always stores as many as possible, and will include all these if you export or copy the data.

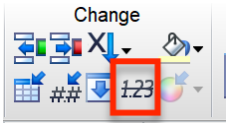
If you want to truly round the values to a certain number of digits after the decimal, you need to round the numbers to a specified number of digits 258.

11.3.9 Excluding or highlighting values

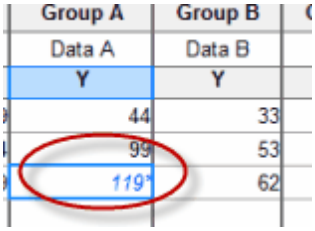
Excluding values from data tables

If a value is too high or too low to be believable, you can exclude it. Excluded values are shown in blue italics on the data table, but are not included in analyses and are not shown on graphs. From the point of view of analyses and graphs, it is the same as if you had deleted the value, but the number remains on the data table to document its value.

To exclude selected values, Click the Exclude button from the Change toolbar.



The excluded values appear in blue italics, followed by an asterisk.



Choose on the File & Printer tab of the Preferences dialog how excluded values should appear when copied to the clipboard. Your choices are to copy a blank value (as if missing), a regular number (ignoring the fact

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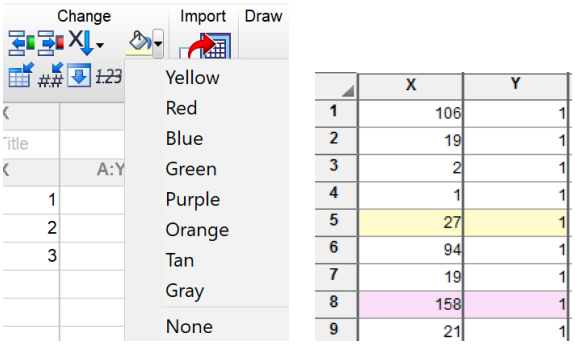
that the value is excluded) or a value followed by an asterisk (to match what you see). Prism offers the same choices on the Export dialog to control how excluded values are exported to .TXT or .CSV files.

Instead of manually choosing points to exclude, you can ask Prism to perform outlier elimination.

Highlighting values

Select a cell or a range of cells. Then click the paint bucket icon in the Change part of the toolbar, or drop Change and choose Cell Background Color. You can choose from eight colors to mark values that you want to double check, or to color code different aspects of an experiment.



Don't confuse highlighting cells in a data (or results) table from highlighting sheet names in the navigator 189.

11.3.10 Deleting or removing entire data sets

Deleting values only

To remove values from the data table, select then and then press the Delete key.

Removing entire data sets

To remove a data set from a Graph, click on the Add/Remove data sets button from the Change toolbar. Alternatively, double click on a graph to

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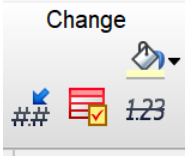
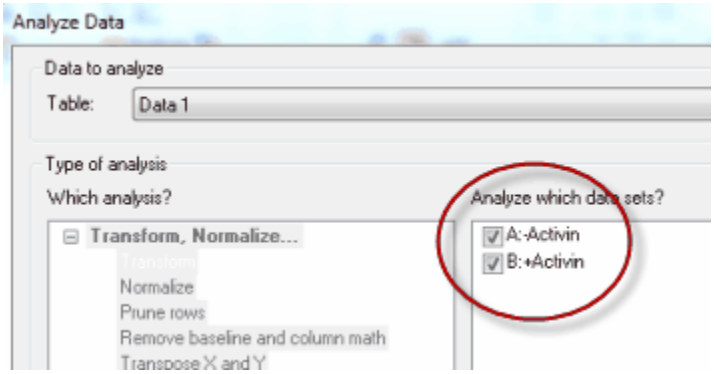
bring up Format Graph, and then go to the second tab. Select the data set to remove.

To remove a data set from a Results sheet, click on the Analyze different data sets button from the Change toolbar, and uncheck the data sets you do not wish to include in the analysis.





11.3.11 Missing values

When entering data, simply leave a blank spot for any value that is missing. Excluded values 253 are treated exactly the same as missing values.

Prism never ever treats an empty cell as if you had entered zero -- it always knows that is a missing value. It will analyze the data if it can, and leave analysis results blank when it cannot. Similarly, it never treats a zero as a missing value.

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The details of how Prism handles missing values differs for various statistical tests.

Unpaired t test; Mann-Whitney test; Ordinary one-way ANOVA; Kruskal Wallis test

These tests work fine with unequal sample size. Missing values are not a problem.

Paired t or Wilcoxon matched pairs test; repeated measures one-way ANOVA

Prism only analyzes rows where there are data for all conditions. If one value is missing, that subject (row) is ignored.

Ordinary two-way (not repeated measures) ANOVA -- Enter raw data

If some values are missing, two-way ANOVA calculations are challenging. If any row/column combinations have no values at all, Prism cannot compute ANOVA. If some row/column combinations have fewer replicates than others (some replicates are missing), Prism uses the method detailed in SA Glantz and BK Slinker. This method converts the ANOVA problem to a multiple regression problem and then displays the results as ANOVA. Prism performs multiple regression three times — each time presenting columns, rows, and interaction to the multiple regression procedure in a different order. Although it calculates each sum-of-squares three times, Prism only displays the sum-of-squares for the factor entered last into the multiple regression equation. These are called Type III sum-of-squares.

Ordinary two-way (not repeated measures) ANOVA -- Enter mean, SD (or SEM) and N

If your data are balanced (same sample size for each condition), entering data as mean, SD (or SEM) and N is not a problem -- you'll get the same results as if you had entered raw data. However, this not the case if your data are unbalanced, it is impossible to calculate precise results from unbalanced data entered as mean, SD (or SEM), and N. Instead, Prism uses a simpler method called analysis of

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"unweighted means". This method is detailed in LD Fisher and G vanBelle (details below). If sample size is the same in all groups, and in some other special cases, this simpler method gives exactly the same results as obtained by analysis of the raw data. In other cases, however, the results will only be approximately correct. If your data are almost balanced (just one or a few missing values), the approximation is a good one. When data are unbalanced, you should enter individual replicates whenever possible.

Repeated measures ANOVA

Starting with Prism 8, Prism can run repeated measures ANOVA (one-, two- or three-way) even with some missing data. It doesn't actually run ANOVA but rather fiits a mixed model. But the results are comparable.

Linear and nonlinear regression

Fitting lines and curves works fine with missing values. You can choose whether Prism fits the individual replicates or fits the means. If you choose to fit the means, each mean gets the same weight regardless of how many values were used to compute it. If you fit the individual replicates, then X values with more Y replicates get more weight than X values with fewer replicates.

Survival curves

Comparison of survival curves does not require equal sample size. If data are completely missing for any subject, simply don't enter data for that subject. But before deciding to leave data out, read about censoring which happens when you know the subject survived up until a certain time, but don't know what happened after that (or you know, but can't use the data because the experimental protocol wasn't followed). Prism handles censored data fine. Don't omit those subjects, enter the duration that they survived on the experimental protocol and mark that duration as censored.

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11.3.12 Keyboard shortcuts

- The Tab key moves to the right. Shift-tab moves to the left.
- The Enter key moves to the right to the next subcolumn, if there is one; otherwise it moves down a row and to the first subcolumn. Shift-Enter does the opposite.
- Shift and Enter does the opposite. It moves left to the prior subcolumn if there is one; otherwise it moves up the the prior row.
- Control and Enter moves down to the next row (same as down arrow key)
- The DEL key erases all selected values, but the data set will still be linked to analyses and graphs. When you enter new data, Prism will update the analyses and graphs. To delete a block of data completely, select Delete from the Edit menu. Other data on the table will move to fill the gap.
- Shift-space selects the entire row (Windows)
- Control-space selects the entire data set (Windows).
- Control-A selects the entire table (Windows).
- Shift-Control-Space selects the entire row (Mac).
- Shift-Option-Space selects the entire data set (Mac).
- Command-A selects the entire table (Mac).

11.3.13 Rounding

How many digits can Prism store?

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Prior to Prism 7, Prism stored only seven digits (actually it is binary, so it is 'about' seven decimal digits) so did not always store the exact value you entered. For example, if you enter the value 99.2492427 into a data table, Prism rounded it to 99.249250.

Prism now stores numbers with double precision, so it can store about fourteen significant figures. If you enter the value 99.2492427 into a data table, Prism stores it as 99.2492427

How to show fewer digits than you entered

By default, Prism tries to show all the digits you entered, and increases the number of digits after the decimal place to accommodate the extra digits. But you can use the Decimal Format dialog 251 to show fewer digits. And the results of analyses can be rounded as well.

What you see on the Prism data table matters only when you look at that table. Notes:

- Choosing to show fewer digits on the data table won't affect how Prism analyzes or graphs your data. Analyses are always based on all the digits you entered (up to the number Prism can store).
- When you save the Prism file (as .PZF or .PZFX), Prism saves all the digits you entered (up to fourteen), so the values are not truncated when you save.
- When you copy data from a Prism data table to the clipboard, Prism copies the values you entered, not only the digits you see on the table.
- When you export a data table as a .TXT or .CSV file, Prism exports the digits you entered, and not only those that appear on the table.

Rounding

There are two issues that can make rounding seem erratic.

- When the next digit is a 5. Rounding values is straightforward unless the next digit is 5. Should 2.5 be rounded up to 3 or rounded down to 2? Both are equally accurate, and many strategies have been proposed to deal with this issue. The Wikipedia article on rounding explains the

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many possibilities. Prism rounds values that end with 5 somewhat unpredictably. For example, 0.25 gets rounded up to 0.3, but 0.45 gets rounded down to 0.4. These are both correct, since rounding a 5 up or down is an arbitrary decision. Prism Windows uses the C function sprintf() to display real numbers. The function used by the Mac Xcode compiler is similar but not quite identical.

- Decimal to binary to decimal. Computers store the number as binary digits, so need to convert to and from decimal. For many values, this requires rounding as well. For example, let's say you type in the number 0.055, and ask Prism to display the value to only two decimal places. The next, third, digit is 5. One common rule to always round up when the next digit is 5, so you'd expect Prism to display 0.06. But the computer can't store the value 0.055. Instead, all values are converted to binary, and the binary value is close to 0.05499996 when converted back to decimal. When rounding this value to two decimal places, the next (third) digit is a 4. So Prism Windows rounds down in this case and displays 0.05. Prism Mac rounds up, in this case, and displays 0.06.

Rounding with Prism 8

The Format Decimal Format dialog rounds down what you see on the table. But when you go to edit the data, all the digits you entered (or imported or pasted) are still present. Starting with Prism 8, you can use a transform round the data to a specified number of digits. This is a built-in transform (bottom of the list) for both X and Y values.

The results will appear on a results page. They will actually show one more digit than you want and that last digit will always be zero. You can use Format Decimal format to show one fewer decimal place. From the results page, you can do further analyses or copy or export the rounded values.

Rounding with earlier versions of Prism

Click Analyze and choose Transform 318. Then choose User-defined Y transform. Then click "Add..." to add a new function. Here is a transform that rounds numbers to only include two digits after the decimal:

```
Y = Floor(Y*10^2 + 0.5)/10^2
```

The transform multiplies the Y value by 10^2 or 100, adds 0.5, and then rounds down to the lower integer (that is what the Floor function does). Then divide by 100.

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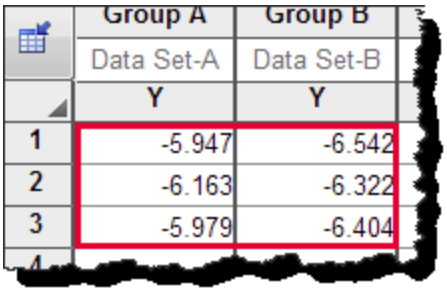
Replace "2" in two places by "3" to round to three places, etc.

The results will appear on a results page. They will actually show one more digit than you want and that last digit will always be zero. You can use Format Decimal format to show one fewer decimal place.

11.3.14 Data objects

Data objects are blocks of data imported or paste-linked from elsewhere. You can't edit these data on that table either because the data are linked to an external text file or to another table in the same Prism project 266. Data blocks appear with thick borders.



	Group A	Group B
	Data Set-A	Data Set-B
	Y	Y
1	-5.947	-6.542
2	-6.163	-6.322
3	-5.979	-6.404

The example above has a red border, because the data were copied and then paste-linked from a red results table. If the values were pasted from a green results table, the border would be green. Green results tables are organized like data tables and (unlike red results tables) can be graphed or further analyzed. If the data were paste linked from another data table, the border is blue. If the data are linked to an external file, the border is black.

11.3.15 Transforming and normalizing?

It is common to want to transform data to perhaps change units or convert to logarithms. On a spreadsheet you can transform right on the same table. Not with Prism. 317 To transform you choose the Transform analysis 318 which puts the results on a new Results table and leaves the data alone.

Similarly, choose a specialized analysis to Normalize 325, Transpose 327, or Remove a baseline 323.

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12 Importing and exporting data

Prism gives you several options to get data from other applications. You can copy and paste, or import.

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12.1 Linking and embedding data

When you copy and paste from an Excel file or text file into a Prism data table, you have the option to paste only the values or to keep a live link to the original file so that whenever the original file is changed and saved, your Prism graphs and analyses will update. A third option is to embed (keep a copy) of the original file inside your Prism file.

When you link, you keep a connection to the original file. When you embed, you make a new copy.

Linking and embedding works differently with Prism for Windows and Prism for Mac:

- With Prism for Windows you can link or embed to Excel and text files.
- With Prism for Mac, you can't embed files or link directly to Excel spreadsheets. You can, however, link to text files.

12.1.1 Changing linked and embedded data

Blocks of Prism data linked to a text file or linked to an embedded spreadsheet (Windows only) appear with a border around them. These are called data objects. You cannot edit these values within Prism. When you click on any cell within a block, you select the entire data object. The figure below shows a data object.

Table format: XY		X	Group A
		Minutes	Treated
		X	Y
1	Title	1	9100
2	Title	2	
3	Title	3	
4	Title	4	
5	Title	5	6400
6	Title	6	6300
7	Title	8	4100
8	Title	10	
9	Title	14	3277
10	Title	20	2444
11	Title	25	
12	Title	30	2099
13	Title	50	1987
14	Title		

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To edit the data:

Double-click anywhere on a block of linked data to bring up the Import and Paste Special 278 dialog. Then click Open File to Edit Data. This will open your original Excel file. After editing and saving the spreadsheet, return to Prism and press Update to close the dialog.

To unlink a data object:

Double-click anywhere within the object to bring up the Import and Paste Special 278 dialog. Click the Unlink button on the bottom of that dialog. The values will remain on Prism's data table, but will no longer be linked to an external file or to an embedded spreadsheet.

To move a data object to a different location on the same table:

Double-click anywhere on the data object to open the Import and Paste Special Choices dialog. Go to the Placement tab. Find the spot where you can change the top-left corner of the object. Enter a row number and choose a column for the new location.

To move a data object to a different data table:

It is not possible to move a data object to a different data table. You can delete it from the table where it doesn't belong. Then go back to the source data, and copy-paste special to the correct location.

To update values in Prism after editing a linked file:

Double-click on the data object in Prism to bring up the Import and Paste Special 278 dialog. Press the Update button on that dialog. This is only necessary if you didn't check the option to automatically update on the Source 279 tab.

To change the region of a spreadsheet file linked to Prism. (Windows only):

If you accidentally linked to the wrong part of a linked spreadsheet, the simplest approach is to unlink the data object, then start over.

An alternative approach is to change the region linked within Prism. Click on the linked data object, then pull down the Edit menu and choose Links.

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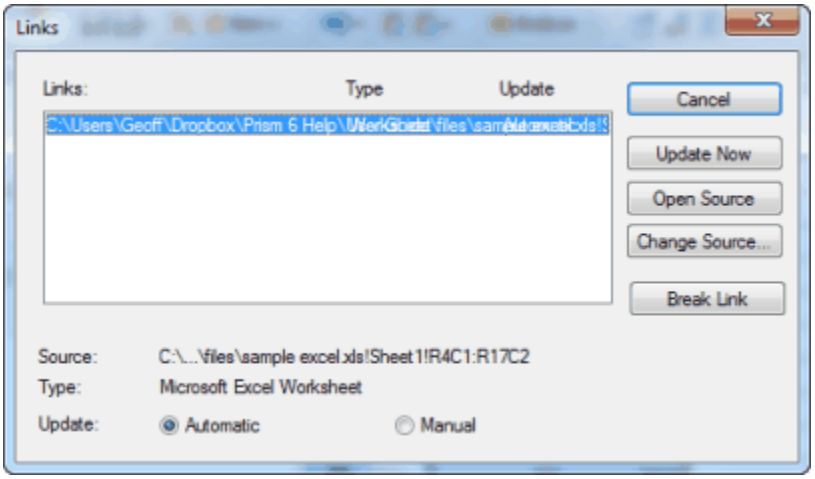
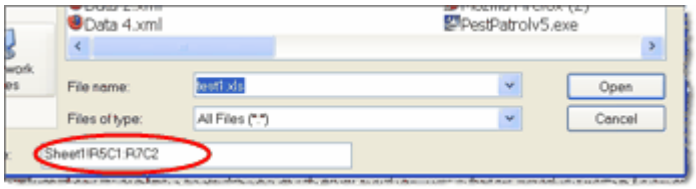


You will see a list of each linked data range on the current Prism table, with the region you selected already highlighted. Press Change Source, to bring up a second dialog.



At the bottom of that dialog, you'll see the current linked range in the field labeled Item Name. With Excel, this range is formatted in an unfamiliar way. R1C3:R100C4 goes from the first row of column 3 to the 100th row of column 4.

Note that you can also use this dialog to link to a different Excel file.

To change the region of a spreadsheet embedded within Prism: (Windows only.)

If you accidentally embedded the wrong part of a spreadsheet, you'll need to copy and paste again. You can't simply delete the data object and start again, because the object contains the embedded Excel table. If you don't have the original spreadsheet file, you need to save it from Prism. To do this, open the embedded spreadsheet from Prism, and then use Excel's File..Save As command to save the spreadsheet as a file. Then you can delete the data object, and start over.

To select a single cell within a Data Object to copy to the clipboard:

It is difficult to select a single cell within a data object. If you click on a cell in a data object, you will select the entire object. To select one cell

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within an object, click on a cell near the object, but outside of it. Then use the arrow keys to move the selection inside the object to the desired cell.

If a linked file has moved:

If the linked text or Excel file is in a folder different than the Prism file: Prism stores the absolute location of the linked file. If the file no longer exists at that location, Prism won't be able to find it, so will not be able to update the data table. However, the imported values remain in the Prism file. You won’t lose any data if the link is broken.

If the linked text or Exel file is in the same folder as the Prism file: It matters whether the Prism file is stored in the .PZF or .PZFX format. If .PZFX, the link is absolute. If the folder has a new name, or has been moved to a new location, the link is lost. If the Prism file is in the .PZF format, then Prism will maintain the link to the Excel or text file that is in the same folder as the Prism file. It doesn't matter if the folder has been renamed or has been moved to a new location.

12.1.2 Paste linking data from Prism

You can copy data (or results), and paste link the data to the same or different data table. You can either use the Paste...Link command on the Edit menu (and the right-click shortcut menu), or choose to link in the dialog that comes up when you choose Paste Special.

The pasted results are linked, which means if the original data are edited or replaced, the linked values will update too.

Example 1

You use nonlinear regression to fit a dose response curve to six data sets. The first three (A-C) are for one drug; the other three are for another (D-F). The logIC50 values are all on one row. You know tha the first three are for one drug, and the next three for another. But Prism doesn't "know" this. The results look like this:

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Best-fit values						
Bottom	1045	936.3	1101	841.4	1301	1160
Top	6097	6225	6035	5943	5812	5849
LogIC50	-5.947	-6.163	-5.979	-6.542	-6.322	-6.404
HillSlope	0.6996	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

You want to put the logIC50 values into a new data table. The first three should go into column A, and the next three into column B. Follow these steps:

1. Select the six values.
2. Copy them to the clipboard.
3. Use New...Data table and graph to make a new Column table.
4. Put the insertion point into Column A and Row 1 of that new table.
5. Choose Paste Special from the Edit (or right-click shortcut) menu.
6. On the first (Source) tab of the Import and Paste Special dialog, choose to insert and maintain link.
7. On the fourth (Placement) tab of that dialog, choose to paste by columns, stacking 3 values in each column. That way the six values that you copied as one row, will paste into two columns.
8. Click OK.
9. Note that the values pasted into the data table are surrounded by a red box. You cannot edit these values on the data table. If you double click within that box, you'll return to the Import and Paste Special dialog (where you can unlink the values, if you want to).

	Group A	Group B
	Data Set-A	Data Set-B
	Y	Y
1	-5.947	-6.542
2	-6.163	-6.322
3	-5.979	-6.404
4		

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10. Prove to yourself that the values are linked. Change the data being analyzed, and notice that the summary values that you paste-linked automatically update.

11. Create a graph of these values using New...Graph of existing data.

12. Compare the groups of values with a test.

13. Download the Prism file.

Example 2

You have two sets of column data that you wish to plot both as a bar graph showing the mean and SD, and also has a scatter graph showing individual values.

One approach is to superimpose the bars and individual symbols. Prism 6 makes this simple, as it offers this as one of the choices for column graphs. This can look good if you omit the error bar, but looks cluttered when you include error bars. I used light colors for the symbols in the graph below, which helped a bit.

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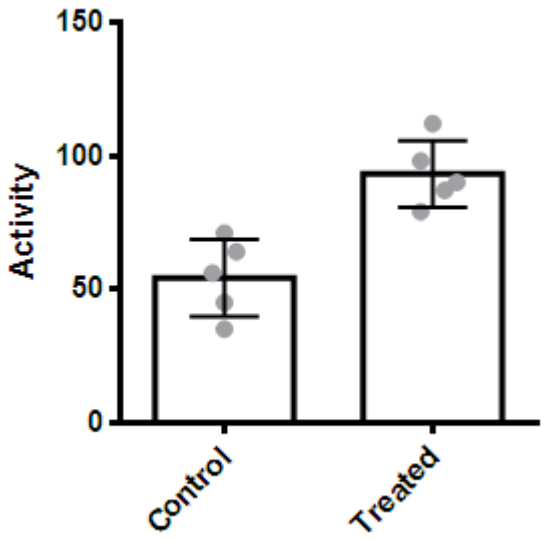

Another approach is to put the bars and symbols side by side. Follow these steps.

1. Enter the two columns of data into columns B and C.
2. Select the values in Column B and copy to the clipboard.
3. Put the insertion point at the top of column A, and choose Paste...Link from the Edit menu (or the right-click shortcut menu).
4. Select the values in Column C and copy to the clipboard.
5. Put the insertion point at the top of Column D, and choose Paste..Link from the Edit menu.
6. Note that the pasted values in Columns A and D are surrounded by a box and cannot be edited.

	Group A	Group B	Group C	Group D
	Control	Control	Treated	Treated
	Y	Y	Y	Y
1	45	45	87	87
2	56	56	98	98
3	64	64	79	79
4	35	35	112	112
5	71	71	90	90

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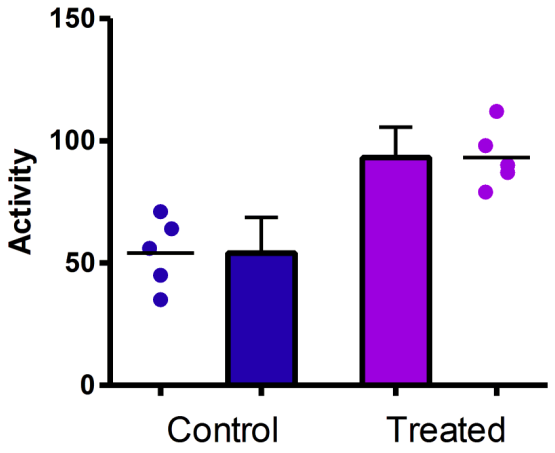
7. Edit a value in Column B or C. Note that Column A and D are instantly updated when you move the insertion point.
8. Polish the graph by double clicking on it, and choosing graphing options for each data set.



12.1.3 Unlinking data objects

When a block of data on a Prism data table is linked to another file (or to embedded data), the data in Prism is included in a box. The box is black if the linked data came from outside of Prism, red or green if the data were paste linked from a Prism results table, and blue if the data were paste linked from a Prism data table.

You cannot edit these values in the data table because they are linked to another source.

To unlink the data block, and allow editing, right click anywhere within the block of data, choose the Data Object command and then choose Unlink.

12.2 Pasting data from Excel (Windows)

Select a range of Excel data and copy it to the clipboard. Switch to Prism, move the insertion point to the cell of a data table that will become the upper-left corner of the pasted data.

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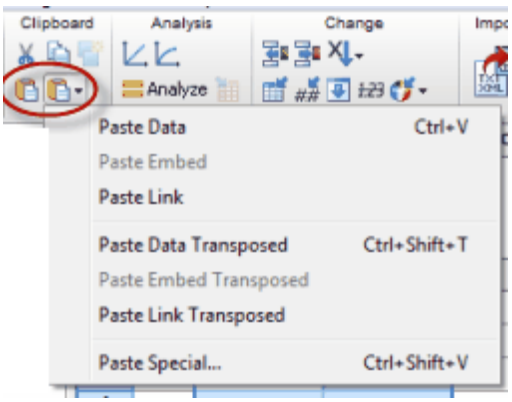
Pasting Excel data

Then click on the Paste or Paste Special button in the Prism Clipboard toolbar.

If you use the Paste button or the keyboard shortcut (Ctrl+V), you will only paste the values that have been copied to the clipboard. If you choose Paste Special , you have several options about how you want to insert your data into Prism's data table. These options are only available with Windows. If you use a Mac, skip to this page 273.



- Paste Data -- Prism retains no link back to the Excel spreadsheet. The values will be pasted and nothing else. The only advantage to using this method is that it is conceptually simpler.

- Paste Embed -- You paste the selected data into the data table and also paste a copy of the entire spreadsheet file into your Prism project, even if it has several worksheets (tabs). This means you don’t need to worry about keeping track of multiple files. You don't need to save the spreadsheet file separately (except as a backup). You can open Excel from within Prism, edit the data, and instantly update the analyses and graphs in Prism. A potential disadvantage of embedding is that you will end up with multiple copies of the same data. Another disadvantage is that your Prism files will be larger.

- Paste Link -- Paste the values into the data table but also create a link back to the Excel file. The link has two functions. It lets you trace (and document) the source of the data so you stay organized. It also is a live link. If you edit or replace the data within Excel, Prism will update the analyses and graphs. The Paste Link command is available only if you

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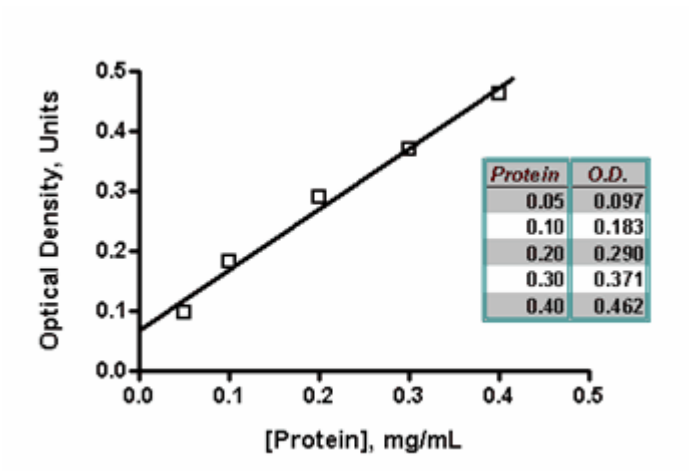
paste from an Excel workbook that has a name. If you are working with a new Excel file, you must first save it (thus giving it a name) before you can link its data into Prism. When in doubt, use Paste Link.

- Paste Data Transposed -- Converts data in Excel rows into columns in Prism, and vice versa.
- Paste Embed Transposed -- Converts data in Excel rows into columns in Prism, and vice versa. You can choose to paste data only, and embeds a copy of the Excel sheet in Prism.
- Paste Link Transposed -- Converts data in Excel rows into columns in Prism, and vice versa. Retains a link to the original Excel sheet
- Paste Special -- Opens dialog to let you choose whether to embed or link to the original file (Windows only), and also choose to filter and rearrange the data as you paste it into Prism. The Paste Special dialog is identical to the Import dialog 278.

Pasting an Excel table as a picture

You can copy a portion of an Excel spreadsheet and paste (or paste link) it onto a Prism graph 391 or layout 544. This pastes a picture only, and Prism cannot analyze or graph the values since the values are not in any Prism data tables.



Importing Excel files

There are some limitations, and we don't recommend it, but you can import 277 Excel files directly into Prism for Windows.

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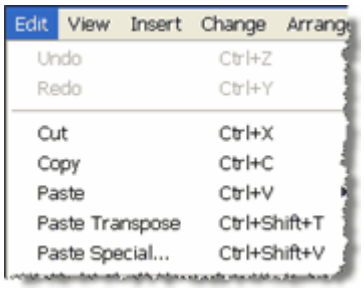
12.3 Pasting data from Excel (Mac)

Pasting data from Excel

Select a range of Excel data and copy it to the clipboard. Switch to Prism and move the insertion point to the cell of the data table that will become the upper-left corner of the pasted data.

Then click on the Paste or Paste Special button in the Clipboard toolbar.



- Paste -- You will only paste the values that have been copied to the clipboard.
- Paste Transpose -- Converts data in Excel rows into columns in Prism, and vice versa.
- Paste Special -- You'll then see the Import and Paste Special 278 dialog, where you can choose whether to filter and rearrange the data (such as transposing).

Note that it is not possible to Paste Embed or Paste Link to Excel files on the Macintosh. Those features only work on Windows.

Pasting an Excel table as a picture

You can copy a portion of an Excel spreadsheet and paste it onto a Prism graph 391 or layout 544. This pastes a picture only, and Prism cannot

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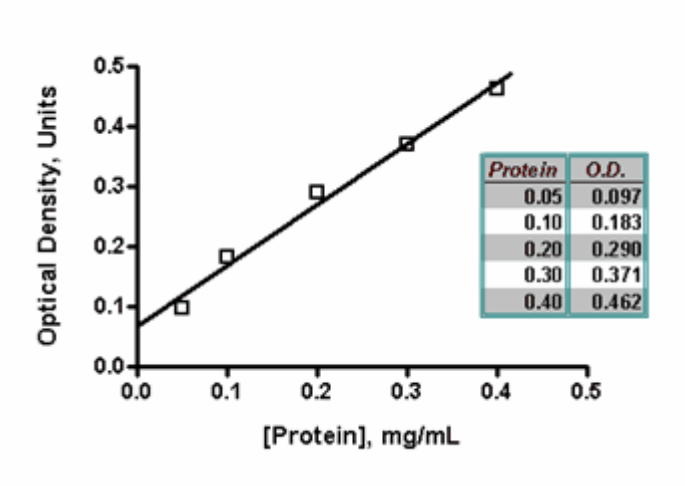
analyze or graph the values since the values are not in any Prism data tables.



Importing Excel files

Prism Mac cannot import Excel files. Either copy and paste, or save from Excel in CSV format and import that text file 275 into Prism.

12.4 Options when pasting data from Excel (win or mac)

What Excel puts on the clipboard

Excel Windows 2003 and later, and Excel Mac 2008 and later, copy data to the clipboard in two formats: Plain text, and HTML.

By default, Prism (starting with 5.0c and 5.03) pastes the HTML format. This will allow much better pasting of Greek letters, superscripts and subscripts, titles with punctuation, numbers with nonstandard thousands or decimal separators, and more.

There is one change. If the Excel cell contains a mixture of numbers and letters (or punctuation), prior versions tried to extract and paste just the numbers. Prism Mac still works that way, but Prism Windows won't paste anything into numerical parts of a Prism table if the corresponding Excel cell mixes numbers and text.

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This new style of pasting only applies when pasting values. Paste-embedding and paste-linking (Windows only) are not changed.

Changing back to the old style

Pasting from the HTML rendition is the default. If it causes any problems, use Edit..Paste Special and check the new option on the first tab:

[x]Paste older text-based clipboard format. Not recommended.

With this option selected, pasting will work just as it did with earlier releases of Prism (before 5.03 and 5.0c). We don't anticipate any situations where this will be helpful, but are providing this option just in case. The option is available when you insert data only, and will be unavailable if you choose to paste link or paste embed.

Numbers, a Mac spreadsheet that is part of iWork, does not copy the HTML so pasting from Numbers always uses the older style.

Two ways to paste from the HTML (older Excel versions only)

It gets even more complicated.

The HTML clipboard version from some versions of Excel contains each number twice. One copy shows exactly what you see in Excel. The other copy shows the value with more decimal places (ignoring formatting or rounding within Excel). By default, Prism pastes the values as they are shown in Excel. But the Paste Special dialog lets you use the other version if you prefer:

[x]Paste as many digits as possible. If Excel rounds to 1.23, paste 1.23456

This option is not available if you copy from Excel Windows 2007 or later, as the necessary information is not copied to the clipboard.

12.5 Importing data from text files

Importing a file vs. opening a file

From the Welcome dialog (or the File Open command), you can only open Prism project files.

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To import data from a file, you must first create a new Prism project (or open an existing one), go to a data table, position the insertion point, and then choose the Import command or click the Import button.

Prism will show you the Import and Paste Special 278 dialog, which will let you choose whether to embed or link to the original file (Windows only), and also will let you filter and rearrange the data as you bring it into Prism.

Formats Prism can import

Prism can import text files delimited with tabs (.txt files) or commas (.csv files).

When thinking about whether Prism can import your files, distinguish the format of the file from the arrangement of the data. Prism arranges data differently than do most programs that can export .csv or .txt files.

To create a text file from an Excel spreadsheet:

Go to the worksheet (tab) you want to export, then pull down Excel's File menu and choose Save as. Select either Text (tab delimited) or CSV (comma delimited) format.

Importing csv files into Excel

If you configure Excel and Windows, you can double-click on a .csv file and have it open directly in Excel. Convenient! But it doesn't work well with some csv files (those with math symbols, Greek letters, international characters). Better to use File Open in Excel, and then choose to open a csv file from and select "65001: Unicode (UTF-8)"

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12.6 Importing text and Excel files directly

Importing Excel files

To import data into Prism (Windows only) directly from an Excel XLS file:

Start from a data table and move insertion point to the cell that will become the upper-left corner of the imported data. Click on the Import button on the Prism toolbar. Whenever possible, transfer data from Excel using copy and paste.

Prism will show you the Import and Paste Special 278 dialog, which will let you choose whether to embed or link to the original file, and also will let you filter and rearrange the data as you bring it into Prism.

Limitations to importing Excel files directly

If your Excel workbook (spreadsheet file) has several worksheets (tabs), Prism only reads one – the one that was selected when the file was saved. Any other worksheets are invisible to Prism.

When importing data from an Excel file, Prism launches Excel invisibly, and asks Excel to send the data to Prism. So Prism can only import an Excel file if Excel is available on the same computer as Prism. Because Excel has to be launched in the background, importing an Excel file can take much longer than importing a text file.

Importing an Excel file requires an OLE (Object Linking and Embedding) connection between Prism and Excel. This is a complicated process, requiring the coordination of Excel, Prism, and various Windows components. While it works fine on most computers, it simply doesn't work on some computers. Because Macintosh computers don't support OLE, importing Excel files directly isn't possible with Prism Mac.

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You'll rarely want to import an entire Excel spreadsheet into Prism. While you can restrict rows and columns to import on Prism's Import dialog, in most cases it is easier to simply copy and paste the appropriate range.

Importing text files

All spreadsheet and statistics programs can export blocks of data as a text file, separating adjacent columns with commas, semicolons, or tabs. Text files commonly have extensions such as .TXT, .DAT, .CSV (comma separated value), or .PRN (printer). Some programs refer to these files as ASCII files rather than text files.

To import data into Prism from a text (ASCII) file:

Start from a data table and move insertion point to the cell in the data table that will become the upper-left corner of the imported data. Click on the Import button on the Prism toolbar.

Prism will show you the Import and Paste Special 278 dialog, which will let you choose whether to embed or link to the original file (Windows only), and also will let you filter and rearrange the data as you bring it into Prism.

Note that it is not sufficient that a file have an extension (file type) such as txt or dat. The file has to be a plain text file. If a file is not a text file, renaming it to have a different extension won't help.

12.7 Importing and pasting choices

The *Import and Paste Special Choices* dialog comes up when you import a file into a Prism data table, or use the Paste Special command. It has five tabs:

Source 279 - The Source tab lets you choose between importing or pasting just the values, linking to a file, or embedding a data object.

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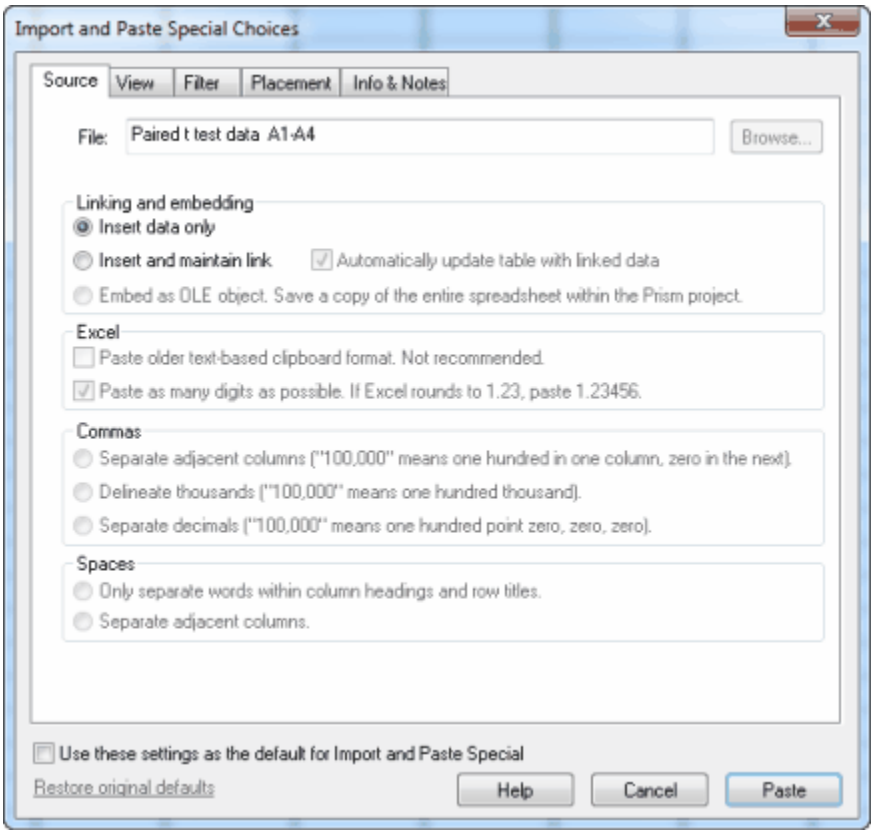
View 281 - The View tab lets you see the contents of the imported or pasted file, divided into columns.

Filter 282 - The Filter tab let you choose which portions of the data file to import.

Placement 286 - The Placement tab lets you rearrange your data as you import/paste it into Prism.

Info & Notes 287 - The Info & Notes tab gives you tools to import sections of a text file directly into a Prism Info sheet 185.

12.7.1 Source tab



Linking and embedding

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Insert Data only

Prism retains no link back to the Excel spreadsheet or text file. The values will be pasted and nothing else. The only advantage to using this method is that it is conceptually simpler.

Insert and Maintain Link

Paste or Import the values into the data table but also create a link back to the original file. The link has two functions. It lets you trace (and document) the source of the data so you stay organized. It also is a live link. If you edit or replace the data in the original data file, Prism will update the analyses and graphs. With Prism for Windows, you can link directly to a text or Excel file. Prism for Mac will link only to text files. With Prism Windows, the Link option is available only if you paste from an Excel workbook that has a name. If you are working with a new Excel file, you must first save it (thus giving it a name) before you can link its data into Prism.

Embed as OLE object (Windows only)

Paste or Import the selected data into the data table and also paste a copy of the entire original spreadsheet or text file into your Prism project, even if it has several worksheets (tabs). This means you don’t need to worry about keeping track of multiple files. You don't need to save the spreadsheet file separately (except as a backup). You can open Excel from within Prism, edit the data, and instantly update the analyses and graphs in Prism. A potential disadvantage of embedding is that you will end up with multiple copies of the same data. Another disadvantage is that your Prism files will be larger.

Automatically update Prism when the data file is changed

If you check this option, whenever you look at a Prism data table, graph, results sheet, or layout, Prism will update the sheet if the linked Excel file has been changed.

Excel options

What Excel puts on the clipboard

Excel Windows 2003 and Excel Mac 2008, copy data to the clipboard in two formats: Plain text, and HTML. Numbers, a Mac spreadsheet that is part of iWork, only copies in plan text format.

When there is a choice, Prism (starting with 5.0c and 5.03) pastes the HTML format by default. This allows much better pasting of Greek letters,

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superscripts and subscripts, titles with punctuation, numbers with nonstandard thousands or decimal separators, and more. You can specify that the text format be used by checking the option:

```
[x]Paste older text-based clipboard format. Not recommended.
```

Two ways to paste from the HTML

It gets even more complicated. With Excel 2003, the HTML clipboard version contains each number twice. One copy shows exactly what you see in Excel. The other copy shows the value with more decimal places (ignoring formatting or rounding within Excel). By default, Prism pastes the values as they are shown in Excel. But the Paste Special dialog lets you use the other version if you prefer:

```
[x]Paste as many digits as possible. If Excel rounds to 1.23, paste 1.23456
```

This option is not available if you copy from Excel 2007 or Excel 2010, as the necessary information is not copied to the clipboard. It is also not available when importing from Excel.

Note a bug in Excel Mac 2008. In very rare cases, using that option will result in the wrong values being pasted into Prism.

How to interpret spaces and commas

The choices are self-explanatory, but important.

12.7.2 View tab

The View tab of the Import and Paste Special dialog lets you see the contents of the imported or pasted file, divided into columns. This can be especially helpful if you are importing from a comma- or tab-delimited text file. A quick look can let you know if your columns are formatted correctly.

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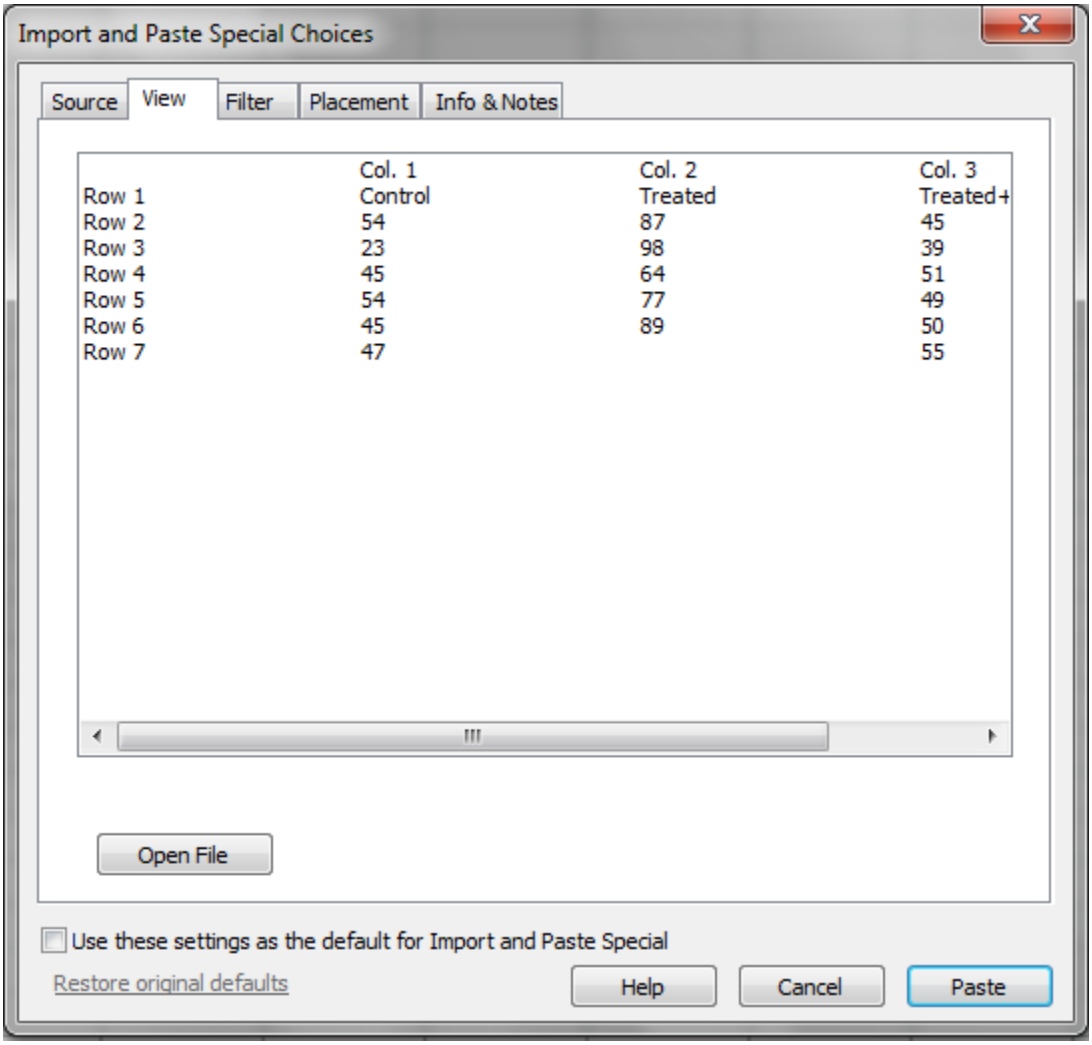

Once you've pasted linked data into a Prism data table, click Open File to open and edit the data file. If it is an Excel file, you'll open Excel. If it is a text file, you will open a text editor.

12.7.3 Filter tab

Choices on the Filter tab of the Import and Paste Special dialog let you choose which portions of the data file to import.

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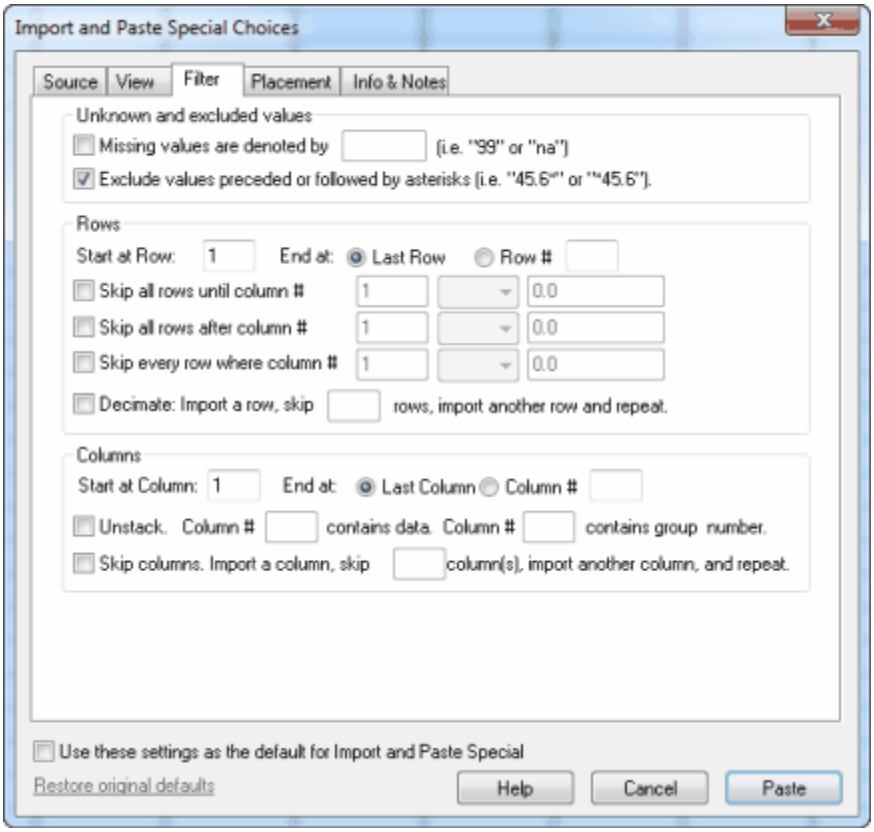

Unknown and excluded values

When entering data, you can leave any parts of the data table empty. Prism automatically figures out what to do with missing values. When Prism imports a text file, it handles missing values automatically. Some other programs use a code, say 99, to denote missing values. If you import data from such a program, enter that code value into the Filter tab.

To denote an excluded value in a text file (or within Excel), put an asterisk immediately after the value. Then check the option on the Filter tab to exclude values followed by asterisks.

Pick which Rows you wish to import or skip

First, select the range of rows to import, by specifying a first and last row. If the file you are importing includes <notes>, <info>, or <title> information (see Paste Special Notes 287), start counting rows at the first row after this structured information. Row "1" is the first row with data, not the first row in the file.

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Then, select rows you want to skip. The filters work by checking whether a designated column meets a criterion you specify. You can apply any combination of three kinds of filters:

- Skip all rows until a criterion is met
- Skip all rows after a criterion is met
- Skip every row that meets your criterion.

When defining the criterion, you can use any column in the original file. You are not restricted to using columns you choose to import. Compare by checking whether the value of each row in the column is less than or equal to (<=), less than (<), equal to (=), greater than (>), greater than or equal to (>=) or not equal (<>) to the value you enter. It is not possible to define criteria that compare values in two columns, only to compare the value in one column with a value you enter in the dialog.

Decimate

If your data file is huge, you can decimate the data as you import. "Decimate" literally means to keep one of every ten rows of data, but you can tell Prism to skip any number of rows between the rows it imports. It imports a row, skips the number of rows you specify, and then reads another row. This is useful with any large file as a way to make Prism files smaller and accelerate analyses and graphing.

Columns

Choose a range of columns you wish to copy by specifying a first and last column. Or choose to read a column, skip one or more columns, and then read another column.

Unstack

Some statistics programs save data in an indexed format (sometimes called a stacked format). Each row is for a case, and each column is for a variable. Different groups or experimental conditions are not defined by different columns (as Prism is organized), but rather by a grouping variable. Prism can unstack indexed data. Specify which column contains the data and which column contains the group identifier. The group identifiers must be integers (not text), but do not have to start at 1 and do not have to be sequential.

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Example: In this sample of an indexed data file, you may want to import only the data in column 2 and use the values in column 3 to define the two groups.

Row #	Col. 1	Col. 2	Col. 3
1	12	123	5
2	14	142	6
3	13	152	5
4	12	116	6
5	11	125	6
6	15	134	5

Check the box to unstack data only from column 2 using column 3 to identify the groups. Prism will automatically rearrange the data, so they look this like:

Row #	First Col.	Second Col.
1	123	142
2	152	116
3	134	125

The column that identifies the groups must contain integers. The lowest integer defines the group whose values will be placed in the column containing the insertion point in Prism. If there are gaps in group numbers, Prism will leave blank columns.

If you use Paste Special to paste data from the clipboard, the column numbers in the Filter tab are relative to the range of data you copied to the clipboard. For example, if you copied cells C13-F45 from Excel to the clipboard, then column 1 in Prism's Filter tab refers to the data in Column C in Excel, the first column of the copied range.

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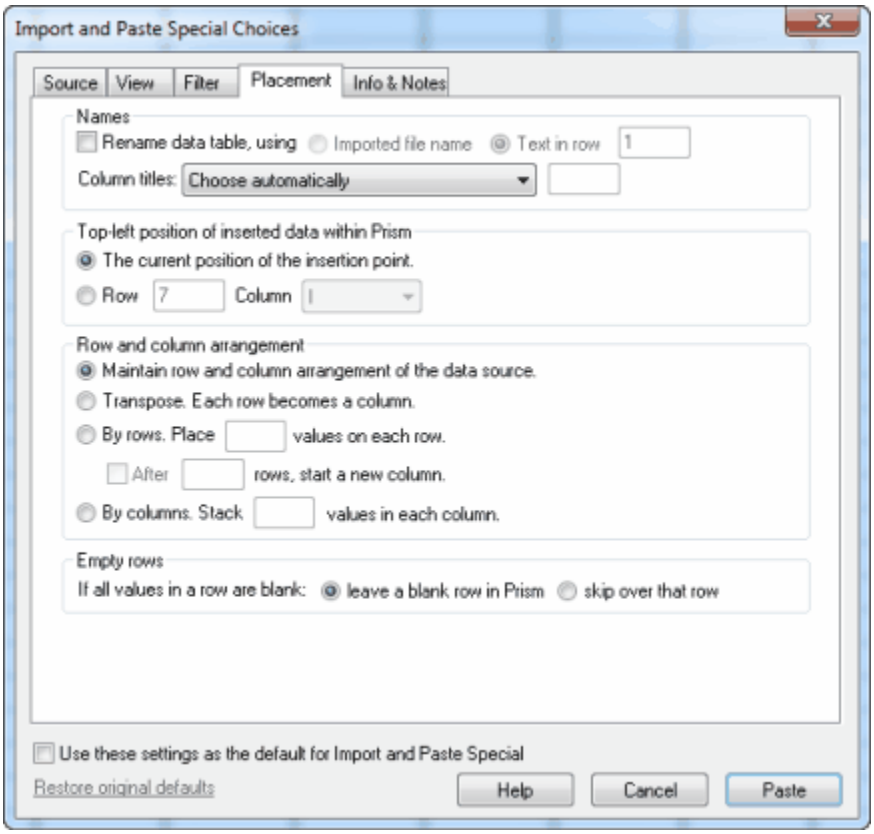
12.7.4 Placement tab

The Placement tab of the Import and Paste Special dialog lets you rearrange your data as you import/paste into Prism.



Names

The Placement tab lets you choose whether you want to rename the Prism data table and/or the Prism column titles with the name of the imported file, or with text imported from a specified row in that file.

Top-left position of inserted data within Prism

Specify the top-left corner of the data object in Prism. Normally, this will be the position of the insertion point when you choose the Import or Paste Special command, but you can change it.

Row and column arrangement

Prism can rearrange the data as it imports. If you choose Transpose, the first row in the source will become the first column in Prism, the second row in the source becomes the second column in Prism, and so on.

If the data source has one column (or row) and you want to organize the data according to your experimental design, choose **By rows** or **By columns.**

Example: Your data source has thirty values in a single column, and you wish to import into a Prism data table formatted for entry of triplicate Y values. The first three values in the source data are the first three replicates. The next three values

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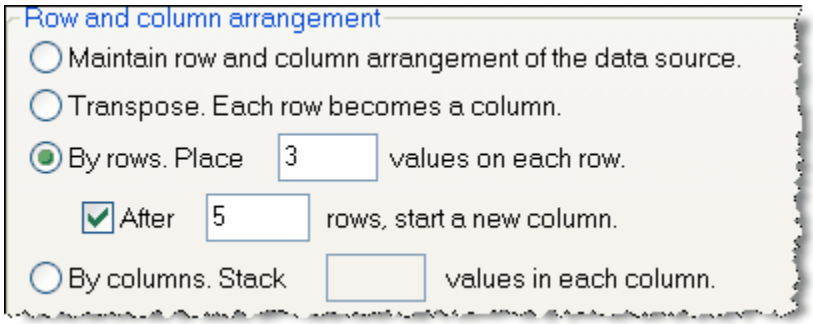
in the source are the next set of replicates, so they belong in row 2 of data set A. After filling five rows, you want to start inserting data into data set B. Choose to import by rows, placing three values on each row and starting a new column after five rows.



If the data source has the values from 1 to 30 in order, Prism will organize the data as shown below. When placing values side-by-side, Prism does not pay attention to the difference between subcolumns and data sets. It just puts values in the next cell to the right, and it doesn't care whether that cell is another replicate, a SD, or the beginning of a new data set. In the example above, Prism placed three values side-by-side because you entered 3 into the dialog. The data table was formatted separately for triplicate values.

A			B		
Data Set-A			Data Set-B		
A:Y1	A:Y2	A:Y3	B:Y1	B:Y2	B:Y3
1	2	3	16	17	18
4	5	6	19	20	21
7	8	9	22	23	24
10	11	12	25	26	27
13	14	15	28	29	30

If you choose to arrange the data “By rows” or “by columns”, Prism reads the values row-by-row from your source file, but ignores all line breaks. It treats the data as though it came from one column or one row.

12.7.5 Info & Notes tab

Prism's Info Sheets are a place to store details about a project or experiment. If you are importing data from a text file (or pasting), you can import ranges of information from a text file directly into a linked Info sheet 185 in your Prism file.

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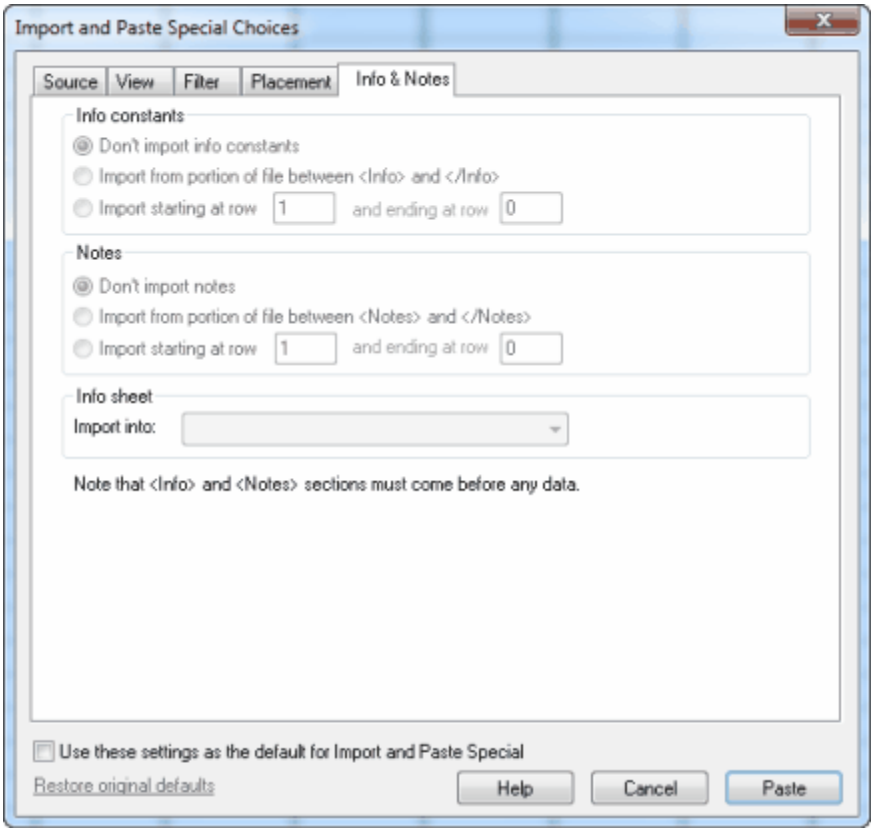

You can import this information at the same time you import your data. Use the Info and Notes tab of the Import and Paste dialog to specify the rows you want to import and which Info sheet you want them to flow into.

If you can control the format of your text file, you can include info constants and notes in structured sections at the beginning of the text file. Mark the sections in the text file with <> variable names as below.

- Mark any values that you want to import to Info Sheets for use as constants as:

```
<Info>
```

- Mark sections you want to go into the freeform Notes areas of an Info Sheet as:

```
<Notes>
```

- Mark a section to use as a title for your Info sheet as <Title>

Example:

```
<Info>
```

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```
Experimenter, "Dave Jones"
"Lot number",   564A
"Specific radioactivity",   345.6
</Info>
<Notes>
The experiment went smoothly, but we noticed a large bubble in the third replicat
</Notes>
<Title>
Experiment of June 32, 2098
</Title>
```

Enter a tab after the <Info> variable name to separate it from its value. If the variable name is two words, use quotation marks around the name.

The three blocks (info, notes, and title) can appear in any order, but they must appear at the beginning of the file. You can include one, two or all three of the blocks,

If the info variable already exists, its value will be updated. If the variable doesn't exist, it will be appended to the Info table.

Notes will be appended to the notes (right) portion of the Info sheet. It is not possible to include Greek letters or super or subscripts when importing.

The title you enter, if you include a <title> section, will replace the data table sheet title.

When you use the View 281 tab to preview your data, the preview will not include the structured information enclosed in notes, info, or title tags. When you enter information on the Filter tab about which rows to include, start counting with the first row following the structured information.

12.8 Troubleshooting: Negative numbers become positive; fractional numbers become integers?

Situations where negative values become positive when pasted or imported into a Prism table:

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- In a contingency table. the rows denote treatment or exposure and the columns denote alternative outcomes. Each value is the actual number of subjects, objects or events. Thus all values must be positive integers or zero. If the data you are importing has any negative values, the minus signs are simply ignored, so the value will become positive. If you want to include negative numbers, you are not really creating a contingency table. Drop the Change menu, choose Format Data Table, and choose a different kind of table. You probably want a Grouped table.

- Excel can be configure to show negative values in red, without the negative sign. When you copy and paste this to Prism, the color is lost but the negative sign is not restored.

- Some financial programs show negative numbers within parentheses. Prism does not understand this syntax, and the numbers will not be pasted as negative values.

- In a survival table, the Y values are a code. One value (usually 1) indicates that the event (often death) occurred. The other value (usually 0) indicates that the data are censored after the specified X (time) value. Negative values are impossible.

Situations where fractional values can become integers when imported or pasted into a Prism table:

- In a contingency table. the rows denote treatment or exposure and the columns denote alternative outcomes. Each value is the actual number of subjects, objects or events. Thus all values must be positive integers or zero. If the data you are importing or pasting has a decimal point, this will be ignored, so "1.23" will paste or import as "123". If you want to include numbers of fractions, you are not really creating a contingency table. Drop the Change menu, choose Format Data Table, and choose a different kind of table. You probably want a Grouped table.

- The Y columns of survival tables hold simple code values. Usually, 1 means death (or some other event happened) and 0 means the data were censored. You can change the code, but Prism can only accept integers into the Y columns of survival tables.

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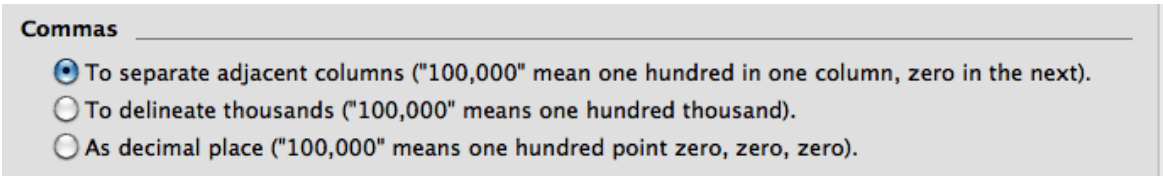
- Number format can depend on where you (or whoever made the text file) lives. A comma sometimes denotes thousands, but sometimes is a decimal separator. If you have trouble, use Edit..Paste Special (instead of plain Paste). The first tab of Paste Special dialog 279 (which is identical to the Import dialog) lets you define what commas mean.



12.9 Exporting from data tables

Copy and paste

The best way to take Prism data or results and place into Word or PowerPoint is via copy and paste. If you do this, you'll find that Prism's tables remain tables when they are pasted. In contrast, if you export then import a text file, Word or PowerPoint won't format it as a table.

When pasting into Excel, or some other spreadsheet or statistical program, note the options at the bottom of the File & Printer tab of the Preferences dialog. Choose whether you want excluded values copied, and whether you want the decimal separator to be a period or comma.

Exporting Prism data

From any data or results table, click on the Export button on the toolbar and choose the format you want to use.

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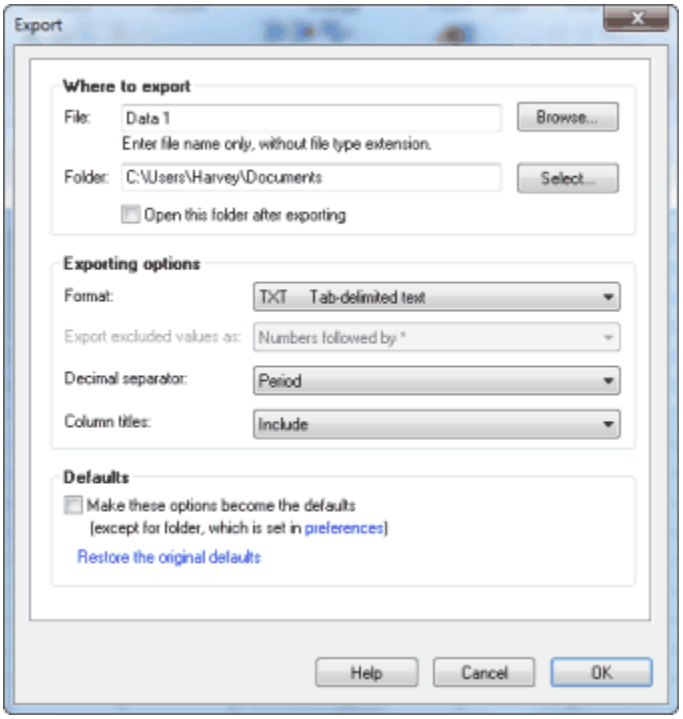

Exporting format

You also can specify how to handle excluded values, how to format the decimal separator, and whether or not to include column titles.

CSV

CSV stands for "comma-delimited values", but the name is a bit misleading. In the Preferences dialog 191, you can choose to export values using a period (point) or a comma as the decimal separator. If you choose a period (the US standard), then adjacent columns are indeed separated by commas. If you choose a comma, then adjacent columns or subcolumns are separated by semicolons.

This is a very standard format useful for moving blocks of data into spreadsheet or word processing programs like Excel and Word.

When Prism exports into CSV, it doesn't distinguish row titles, X columns, Y columns, and subcolumns. All the values are simply exported. Special characters (Greek, subscripts, etc.) are lost from column and row titles.

TXT

This format is very similar to CSV, except that adjacent columns are separated with tabs. These are common formats and can be used to easily

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move blocks of data into spreadsheet or word processing programs like Excel and Word.

This is a very standard format useful for moving blocks of data into spreadsheet or word processing programs like Excel and Word.

When Prism exports into TXT, it doesn't distinguish row titles, X columns, Y columns, and subcolumns. All the values are simply exported. Special characters (Greek, subscripts, etc.) are lost from column and row titles

XML

When you export in XML format, the exported file includes all special formatting, including Greek characters, subscript, superscript, subcolumn formats, etc. When you later import an XML file, everything should just work. There is no ambiguity about whether commas are for decimals, thousands, or used to separate columns.

If your goal is to export a data table from Prism on one computer and import it into Prism on another computer, you should choose XML format.

While Prism follows standard XML conventions, the way Prism denotes unique features such as subcolumn, excluded values, floating notes, etc. is unique, so files can't be directly imported into other programs without some extra work.

An XML style sheet is appended to every XML file exported. That means you can view the file in a web browser, and see your data tables as tables. But don't be fooled by this. You are not viewing the XML file, you are viewing a rendition of the file as specified in a style sheet that is appended to every XML file Prism exports. To see what the file actually looks like, use a text editor.

We provide the XML schema in the Prism program folder (prism6xmlschema.xml). Using that (and by exporting sample files from Prism) a programmer could enable other programs to export data in Prism XML format.

In addition to exporting data tables as XML, Prism can save an entire project in a new XML based file format (PZFX 191).

More choices when exporting or copying data

How should excluded values be handled?

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The idea of excluding values is unique to Prism, so there is no standard way to denote exclusion when exporting data. Prism 6 offers three choices. Excluded values can appear:

- Just like all other values, ignoring the fact that they are excluded.
- Followed by an asterisk.
- As missing values, blanks.

What should the decimal separator be?

You have three choices:

- A period or point (1.23).
- A comma (1,23).
- Let Prism decide, based on your Windows or Mac control panel.

These choices are set in the export dialog when you export to a file. When you copy the data to paste somewhere, these choices are set in the File & Printer tab of Preferences dialog.

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13 Analyzing data with Prism

This section explains how to analyze data with Prism. For help with statistical principles, and with particular analyses, go to the Statistics Guide.

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13.1 Analyzing data: The basics

What 'analyze' means in Prism 296
How to analyze data with Prism 296
Statistical analyses and linear or nonlinear regression 298

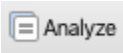
13.1.1 What 'analyze' means in Prism

Prism uses the term *analyze* to include not only statistics and regression, but also for data manipulations such as transforming, removing baselines, and normalizing. In all cases, the results of each analysis appears on new results pages and the data table does not change. For example, if you transform data, the transformed values do not replace the data. Instead they appear in a new results page.

Data and analyses are linked. If you change the data, the analysis results will update automatically as will any linked graphs. This works even if you have chained several analyses 301. You can stop the automatic updating by freezing 303 the results sheet.

13.1.2 How to analyze data with Prism

Start from any data table or graph, and click the Analyze button. There is no need to first select a range of data to analyze. Prism completely ignores any selection you made before clicking the Analyze button.



Step 1. Analyze dialog

The analyze dialog appears. Make sure the drop down on the upper left is set to 'Built-in analysis', and choose an analysis.The right half lets you choose to only analyze selected data sets. It is not possible to choose a subset of rows to analyze -- Prism always analyzes them all.

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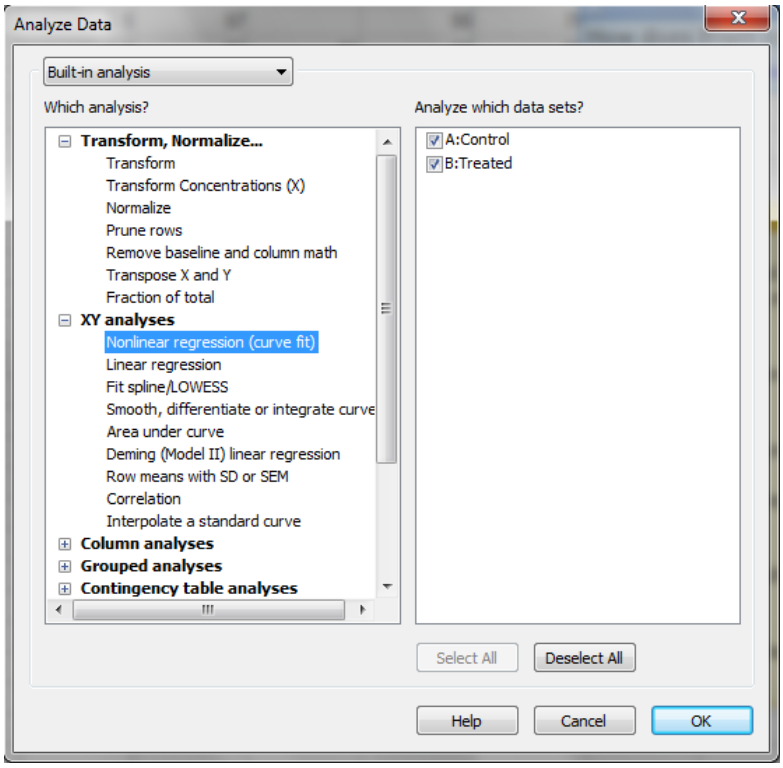

Step 2. Analysis parameters dialog

Each analysis dialog has its own parameters dialog. Read about individual analyses to learn about the choices.

If you are unsure about an analysis choice, click the Learn button in the dialog to go to the appropriate help topic.

Step 3. View the results

Some results are presented on several analysis tabs 298. Choose an analysis tab to view .

Step 4. Analysis checklist

Click the Analysis checklist button in the Interpret section of the Prism toolbar to review a list of questions that will help you interpret the results..

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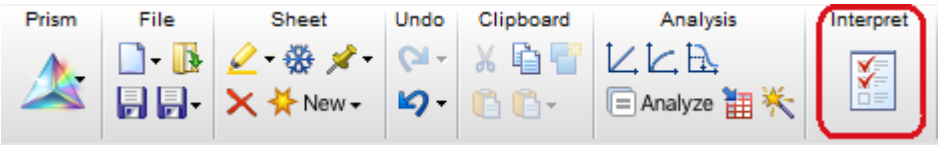

13.1.3 Statistical analyses and linear or nonlinear regression

Prism comes with three on-line guides (help). The details of statistics and regressions are explained in the other guides.

- View the Statistics Guide
- View the Curve Fitting (Regression) Guide

13.2 Working with results of analyses

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Repeating an analysis 303
Graphing results 303
Frozen and orphaned analysis results 303
Excluding data points from an analysis 304
Embedding results on a graph 305
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13.2.1 Analysis tabs

Viewing analysis tabs

Many analyses in Prism present results on more than one table. Prior to Prism 8, these were called "views" or "subpages" of the results and they were shown indented under the main results entry in the Navigator. Starting with Prism 8, these tables are shown as analysis tabs. Here is a nonlinear regression results (with optional outlier detection) shown in a second tab.

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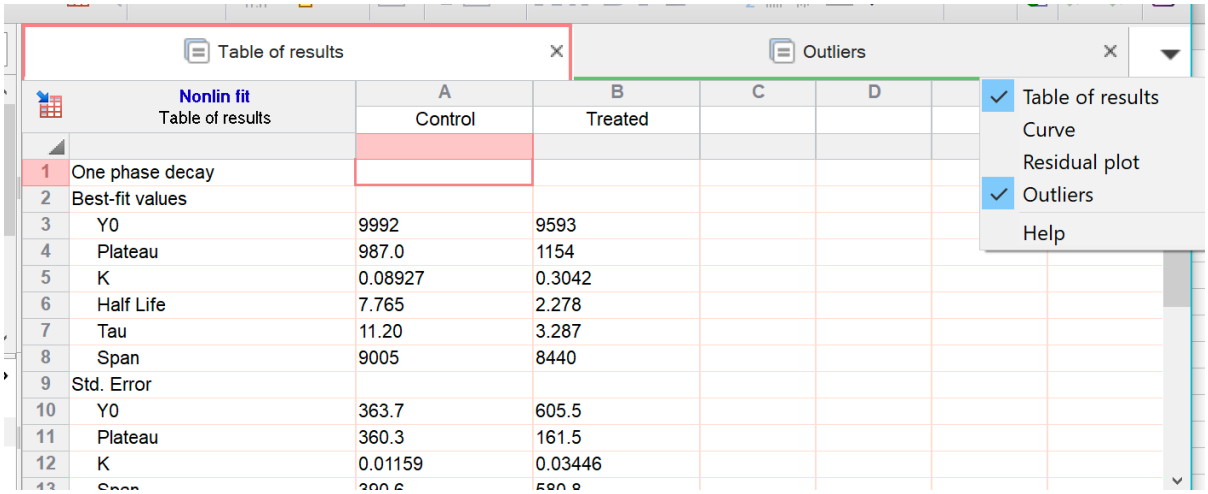

Notes:

- If the analysis has only one table of results, you won't see any analysis tabs.
- Some analysis tabs have a red border. These are tables to look at. But they can't be graphed or further analyzed because different rows have different kinds of data.
- Some analysis tabs have a green border. These are tables that can be graphed or analyzed further. Drop the New button and choose New Graph of existing data or New Analysis.
- You can hide analysis tabs by clicking the "X" in the analysis tab. Read on to learn about hidden tabs.

Hiding and unhiding analysis tabs

To the right of the analysis tabs is a downward pointing arrow. Click it to see the full list of analysis tabs, including those that are hidden. The analysis in the screenshot below has four analysis tabs. Two are visible (checked) and two are invisible (unchecked).

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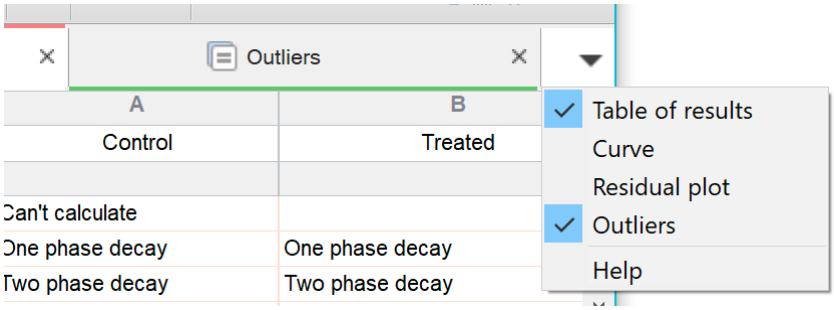

Why are some results tabs hidden by default?

Some analyses create results tables that are used to create graphs, and there is really no point in viewing these tables. For example, nonlinear regression can creates a results tab showing the XY coordinates of the curve and another showing the residuals, Prism (starting with Prism 8) hides these results tabs by default since you will probably only want to look at the linked graph, and not the table of values. But you can choose to show these tabs if you want to.

Why would you choose to hide other tabs?

You can hide any results tabs you want to. If you are preparing a file for others to view, you may want to hide some less important analysis tabs. For example when interpolating standard curves, you may want to hide the tabular results. Another example: If you do an ANOVA but only care about the followup multiple comparisons tests, you may want to hide the main results table with the ANOVA results.

How to hide a tab

You can make any analysis tab invisible by clicking the "X" on the tab, or unchecking that tab in the list of tabs. This can be useful when you are preparing a file to show others. Maybe the whole point of regrssion was to interpolate unknowns, so you only want the interpolated results to be visible and want everything else to be invisible. Or maybe you did ANOVA followed by multiple comparisons, but you want to hide the main ANOVA results so as to put the focus on the multiple comparisons results.

How to make a tab visible

Any hidden analysis tab can be made visible again by checking the option box in front of its name.

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Keyboard shortcuts

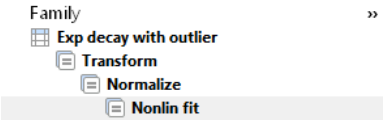
Windows: Hold Control and click Tab to move to the next analysis tab

Mac: Hold Command and press [to move to the next analysis tab,] to move to the prior one.

13.2.2 Creating chains of analyses

Results tables that can be analyzed further have green grids (in contrast, tables with red grids cannot be analyzed further). There is no limit to how many analyses can be chained together in this way. When you edit or update the data table, Prism will update the entire analysis chain automatically.

In Family pane below the Navigator, analysis chains appear as a series of indented sheet names. In this example, data are first transformed, then normalized, and then fit with nonlinear regression.



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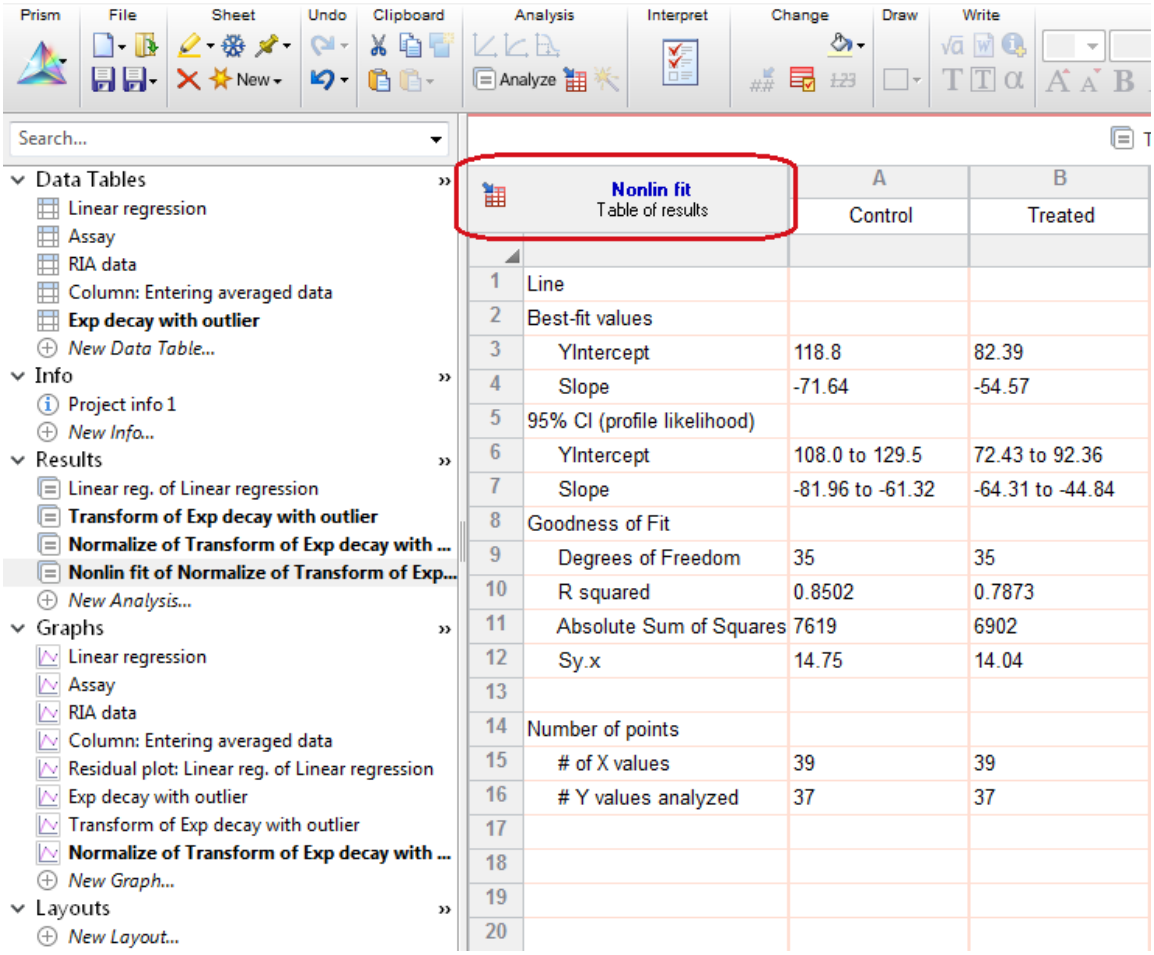
13.2.3 Changing an analysis

After reviewing the results of an analysis, you may want to change your choices. Click on the Results button in the upper left corner of any analysis results sheet to open the Analysis Parameters dialog.



Two buttons in the toolbar let you change an analysis:

-- Change the analysis parameters (choices).

-- Change which data table and data sets are analyzed.

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13.2.4 Repeating an analysis

If you have already entered data on a new data table, and want to analyze it exactly like you have already analyzed an existing table, use the Wand 175 (Wizard to ANalyze Data).

If you haven't yet entered the new data, consider duplicating the current data table with its family 171. Then edit or replace the data on the new table and the analyses will update.

If you have placed parts of the analysis on the graph (regression lines or curves, or copy and paste a results table), then you can clone that graph 173.

13.2.5 Graphing results

If the results table has a green grid (but not a red grid), you can make a graph of the results. To do so, click the New button and choose Graph of existing data. Then choose the graph you want to make.

13.2.6 Frozen and orphaned analysis results

Frozen results

When you edit or replace data, Prism automatically recomputes all linked analyses. If you don't want a particular results sheet to automatically update when the data are changed, click the freeze button in the Sheet section of the toolbar.

For example, you might want to freeze the results before excluding some outliers from the data, then repeat the analysis and have both copies of the results in the project. Click again to unfreeze. When a sheet is frozen, you'll see the word "frozen" in the status bar at the bottom of the window, as well as a floating note that explains.

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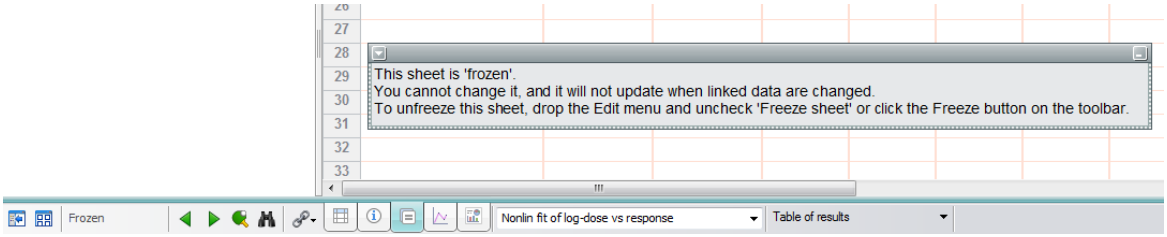

Note the distinction between deleting a data table and deleting all the values. If you erase all values from a data set using the DEL key, Prism still maintains the links between the data and the results. Since there are no data, the results become blank. If you delete the entire data table, the results remain and the sheet becomes orphaned.

Orphaned results

Prism hot links data to analysis results. If you change the data, Prism will automatically recalculate the analyses and update the results. It will also update any result tables that have been embedded 305 onto graphs, or any result values that have been hooked 306 to dialogs.

If you delete a data table, any linked results become *orphaned*, and you'll see the word 'orphaned' in the bar at the bottom of the Prism window. When the data table is gone you can view and graph the orphaned results, but you cannot change the analysis parameters.

13.2.7 Excluding data points from an analysis

Excluding data sets

If you want to only analyze selected data sets, you can do so. Don't exclude 253 all the other points. And don't expect your selection of data sets to matter when you click the Analyze dialog. Instead, you choose which data sets to analyze on the right side of the Analyze dialog. You can change your mind later via Change..Data analyzed.

Empty data sets

How does Prism deal with empty data sets (or data sets with all values excluded) when analyzing data. If you selected to analyze all the data sets (the default), then Prism leaves empty data sets in results if there

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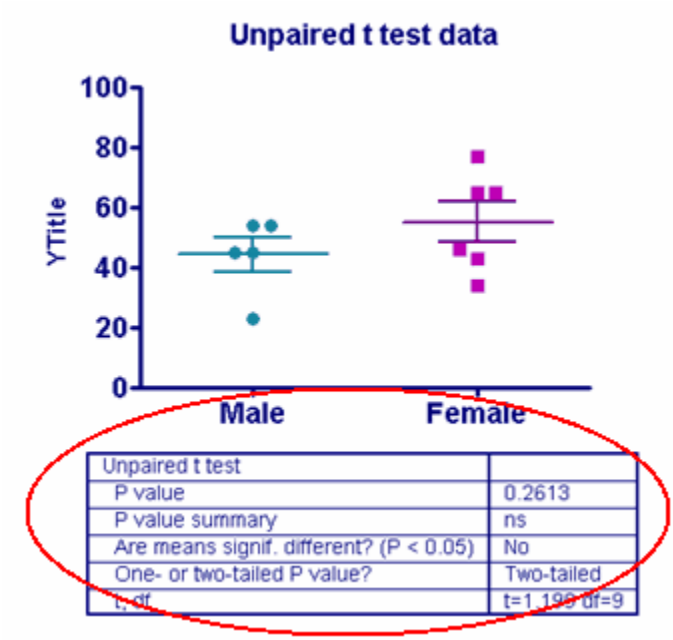
are empty data sets in the data table. That way the data set letter is always the same for data tables and results. In other words, the results for data set E are always in results data set E. But if you selected to only analyze selected data sets, Prism only analyzes selected data sets that are not empty. If you choose to analyze data sets C, D and E, but data set D is empty, then the results for data set C will appear in column A of the results table, and the results for data set E will appear in column B in the results table.

Excluding a range of rows

Prism is set up to work with sets of data set columns. There is no way to select a range of rows to analyze. The workaround would be to duplicate the table, and then remove unwanted rows from the copy.

13.2.8 Embedding results on a graph

You can copy any part of a results table and paste it onto a Prism graph or layout. The link will be 'live' so will be updated if you edit the data or change the analysis parameters.



Double-click on the embedded table to bring up a dialog that will let you adjust its font, borders, etc.

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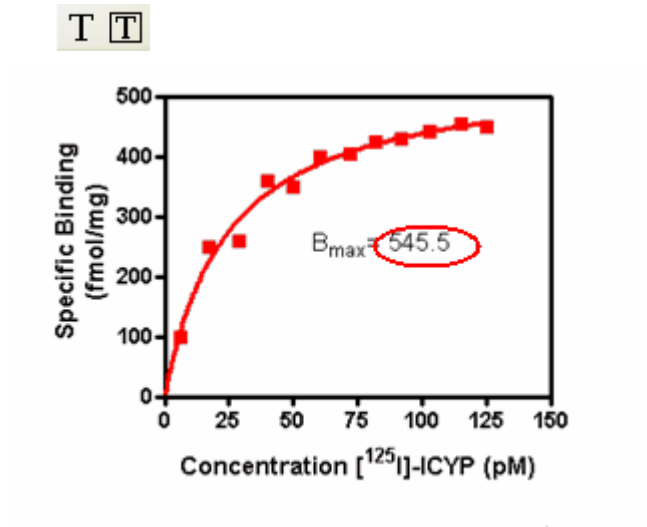
When you copy a single cell of a table, you have two choices when pasting:

- **Paste as text** -- First use Prism's Text tool to create a text box, then paste a results sheet value into it. In this case, the value you copied will be pasted as text, with no link back to the analysis.



- **Paste as link** -- If you paste directly onto the graph or layout (not while entering text), you will paste an embedded table (with one cell) that will automatically update when the results are recomputed.

13.2.9 Hooking to analysis and info constants

What is hooking?

Prism lets you 'hook' the results of some analyses into the parameters dialog of other analyses, and graphing dialogs. The value you hooked is then used in that analysis, or graphing choice. The link is live, so will be updated if the data are edited or (in some cases) if the analysis parameters changed.

You can also hook constants entered on an Info sheet.

Which analysis results can be hooked?

Here is the list of all analysis results that can be hooked.

Analysis	Values that can be hooked

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Nonlinear regression	• Best-fit value of each parameter • Lower confidence limit of each parameter • Upper confidence limit of each parameter
Survival analysis	• Median survival
Bland-Altman	• Bias • Lower 95% confidence limit of bias • Upper 95% confidence limit of bias
Descrptive statistics	• Mean with lower and upper confidence limits • Geometric mean with lower and upper confidence limits • 25th and 75th percentile • Median • Lowest value • Highest value • QC control lines (Mean plus or minus 1, 2 or 3 SD) • SD • SEM • N • Sum

You cannot add to this list (but we can, so send us suggestions).

How to hook?

You'll see hook icons on many dialogs next to fields requiring you to enter a value. Click, and then choose an analysis constant (or info constant) on the Hook dialog.

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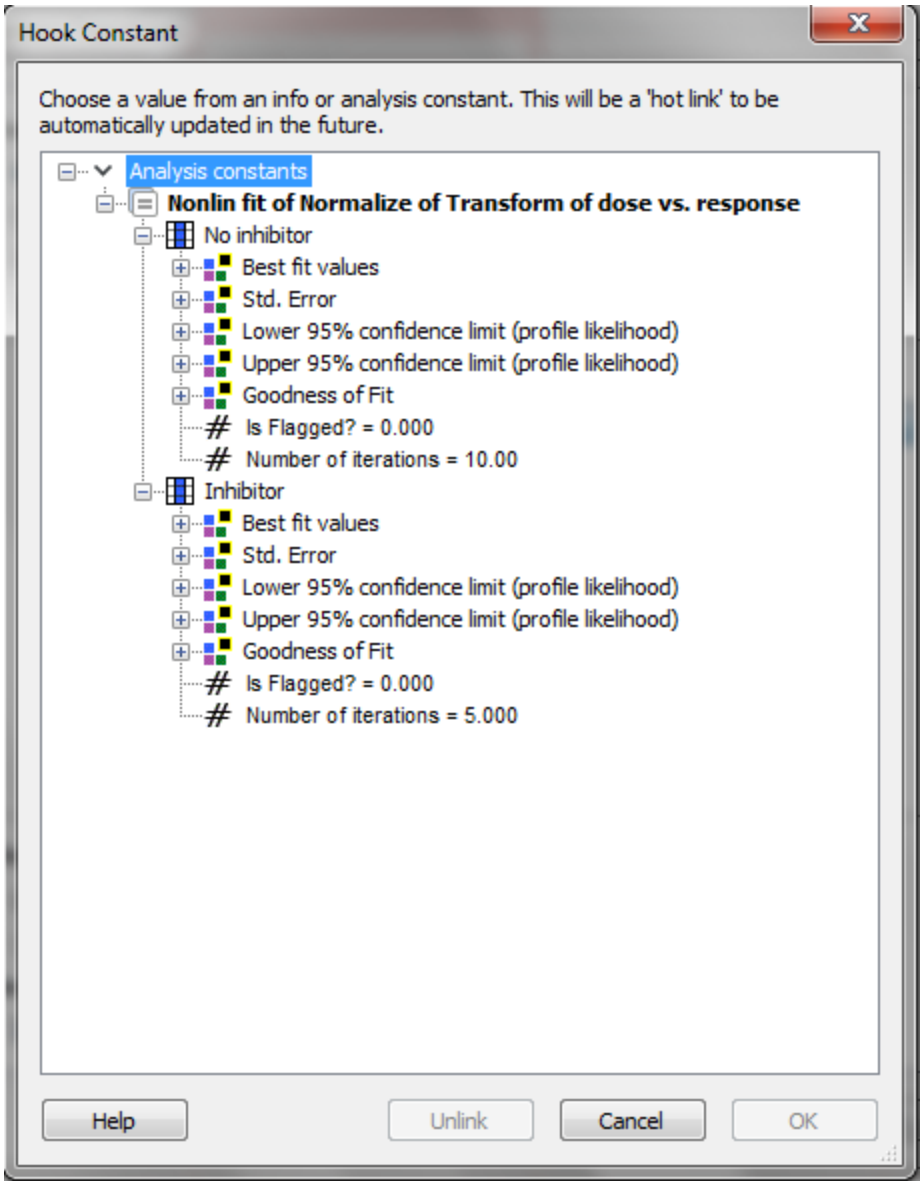

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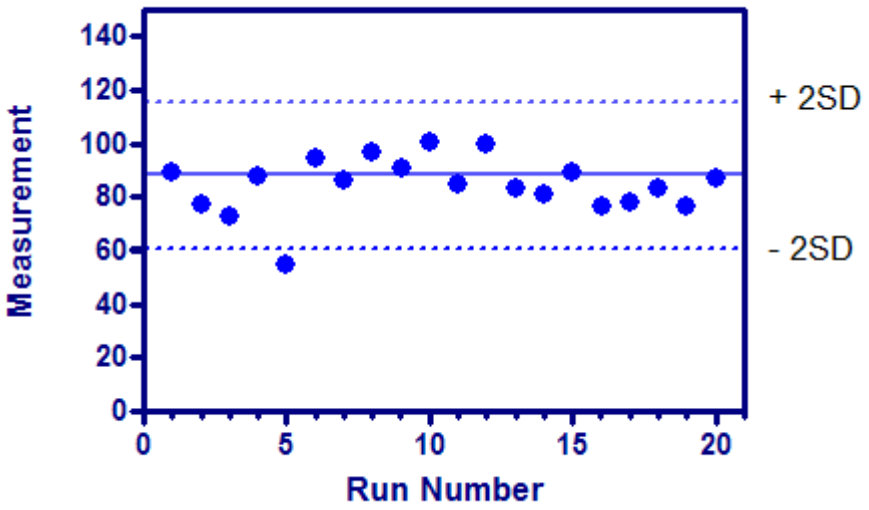
Example 1. QC plot



The graph shows repeated quality control measurements. The descriptive statistics analysis was run to compute the mean and SD (and more) of the values. The lines at the mean and plus or minus two standard deviations were drawn by hooking these values. This means that the grid lines will move as more data are entered into the data table.

First double click on the Y axis to bring up the Format Axes dialog on the Y axis tab. The bottom of the dialog lets you add additional ticks and grid lines. To hook the grid line to an analysis constant requires drilling down to the details dialog, so click the '...' button.

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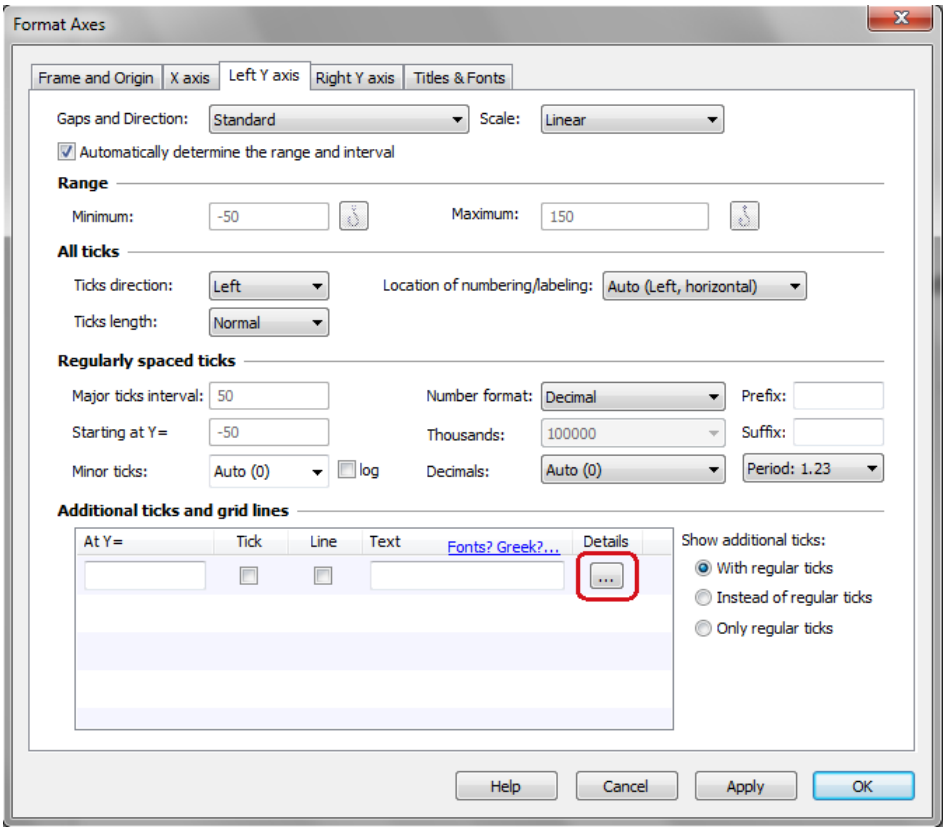

You don't want to enter a Y coordinate on the Format Additional Ticks and Grids dialog. Instead you want to hook an analysis constant. Click on the hook button, and then choose the value you want to hook (first the mean, later the two QC control lines). Back on the Format Additional Ticks and Grids dialog, choose the kind of line (solid or dotted) and its color. You can also choose to fill between the two QC lines

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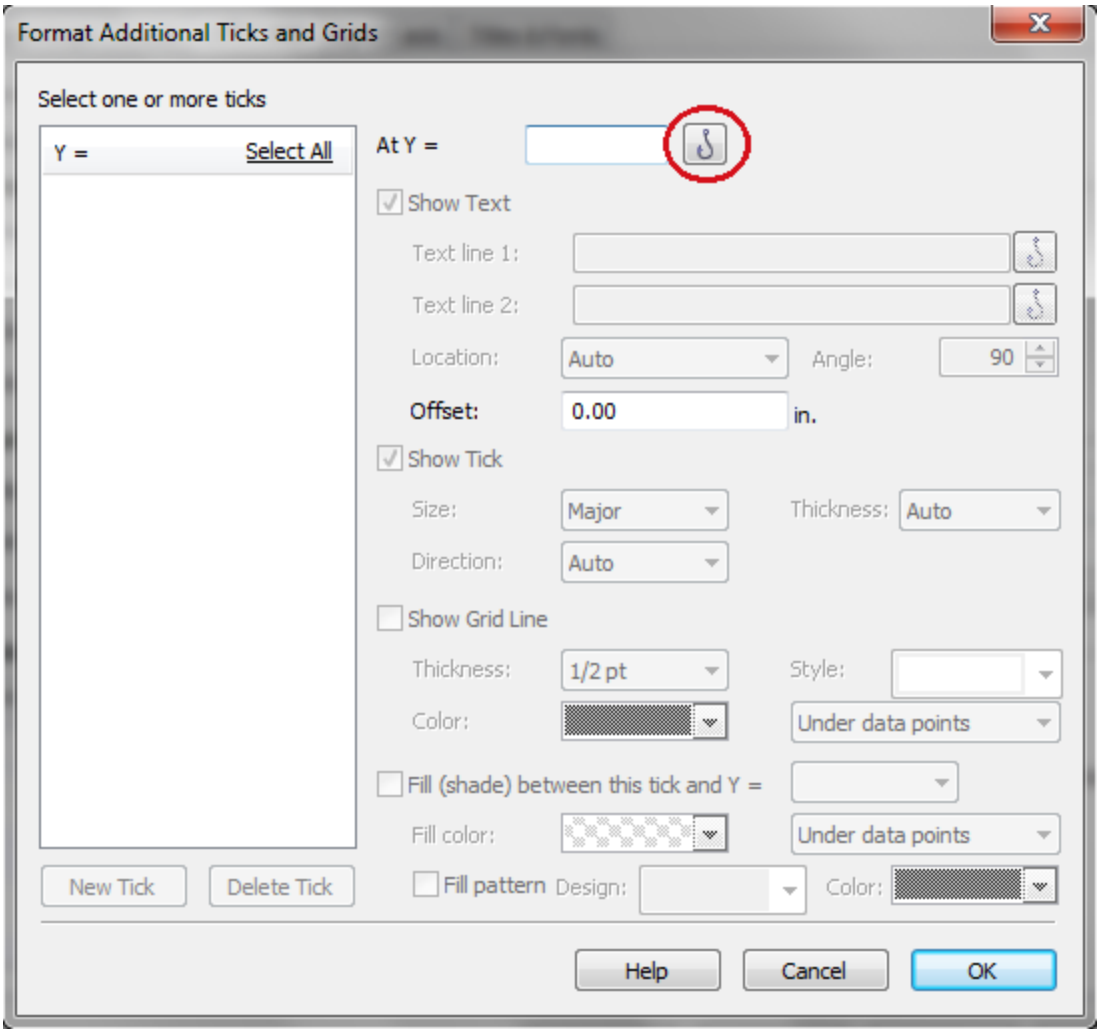

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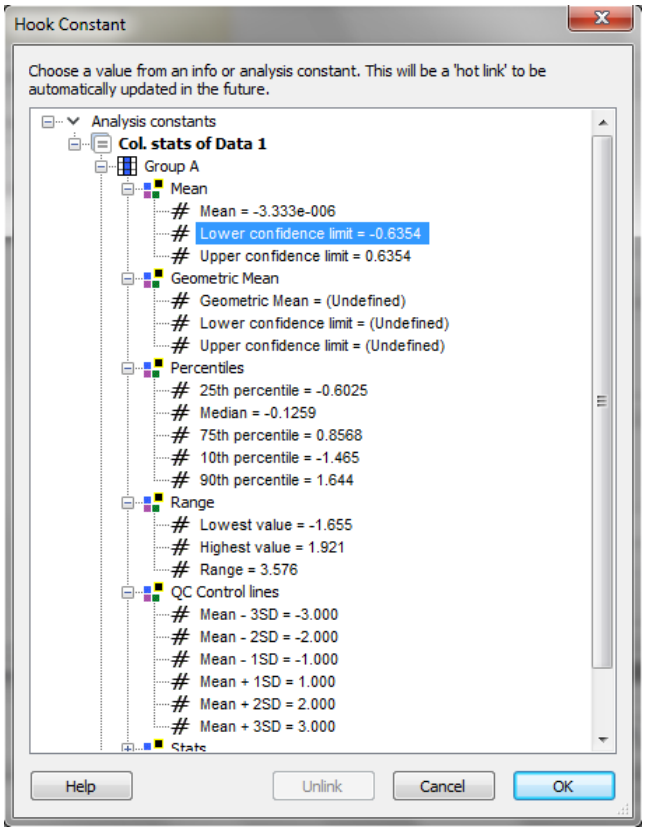
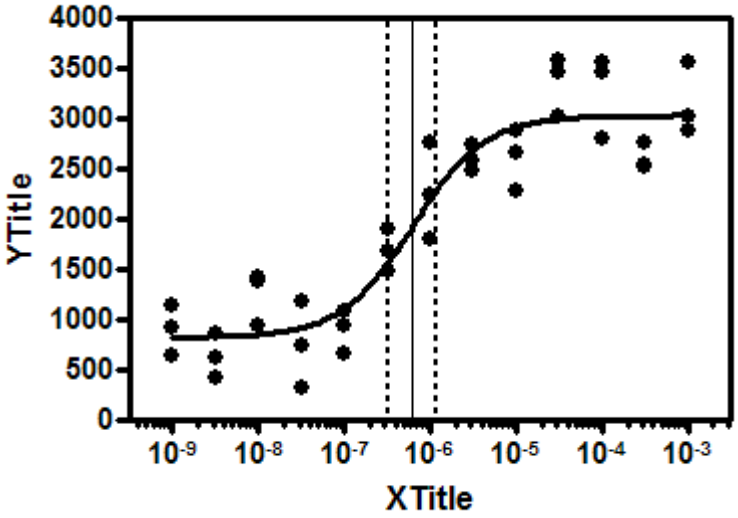


Example 2. Confidence interval of EC50



This example shows grid lines at the EC50 along with its 95% confidence interval. All three values were 'hooked' from the nonlinear regression

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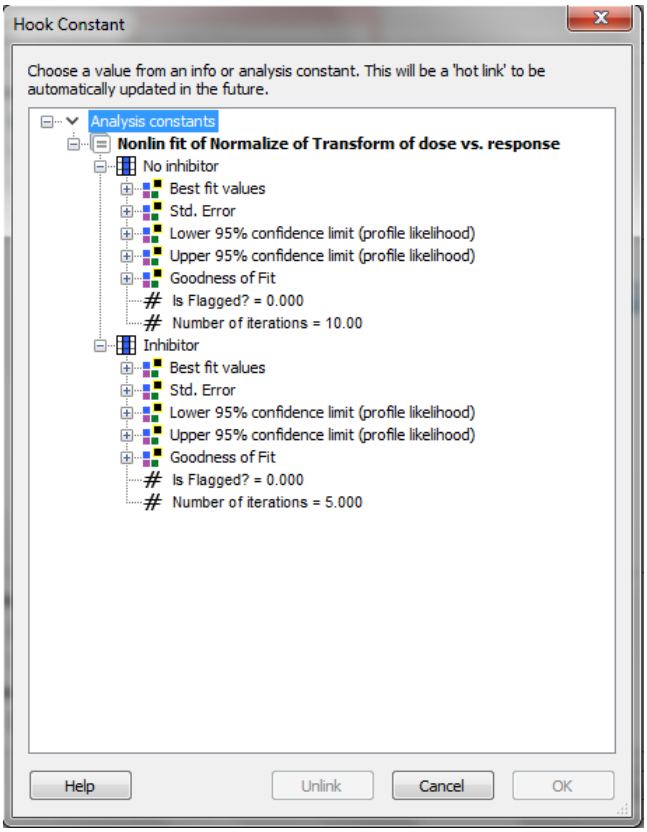
using Additional ticks and grid lines 503, so will move if data are edited or replaced.



13.2.10 Color coding key results

It is easy to color code selected cells a results tables. This would be useful to highlight the key results, or to mark surprising results you wish to review further. To do so:

1. Place the insertion point in the single cell you wish to color code. Or drag to select a range of cells.
2. Click the paint bucket icon in the Change area and choose a color. Or drop the Change menu and choose "Cell Background Color".

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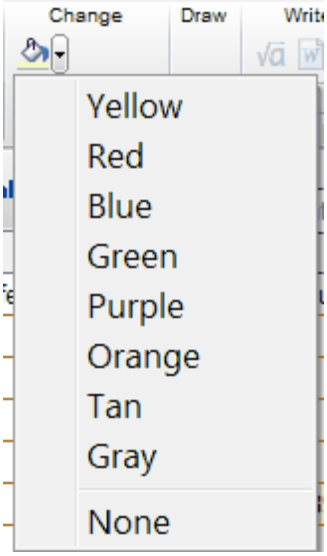

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	Unpaired t test	
1	Table Analyzed	Unpaired t test data
2		
3	Column B	Female
4	vs.	vs.
5	Column A	Male
6		
7	Unpaired t test	
8	P value	0.2613
9	P value summary	ns
10	Significantly different (P < 0.05)?	No
11	One- or two-tailed P value?	Two-tailed
12	t, df	t=1.199, df=9
13		
14	How big is the difference?	
15	Mean of column A	44.20
16	Mean of column B	55.00
17	Difference between means (B - A) ± SEM	10.80 ± 9.010
18	95% confidence interval	-9.583 to 31.18
19	R squared (eta squared)	0.1377
20		
21	F test to compare variances	
22	F, DFn, Dfd	1.680, 5, 4
23	P value	0.6354
24	P value summary	ns
25	Significantly different (P < 0.05)?	No

Note the distinction between the feature explained here with a related feature that lets you highlight (color code) sheet names in the navigator.

13.3 Transforming, normalizing, etc.

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Before graphing or analyzing your data, you may first need to do some calculations to get your data into proper form. While Prism is not as versatile as Excel, Prism can do many data manipulations.

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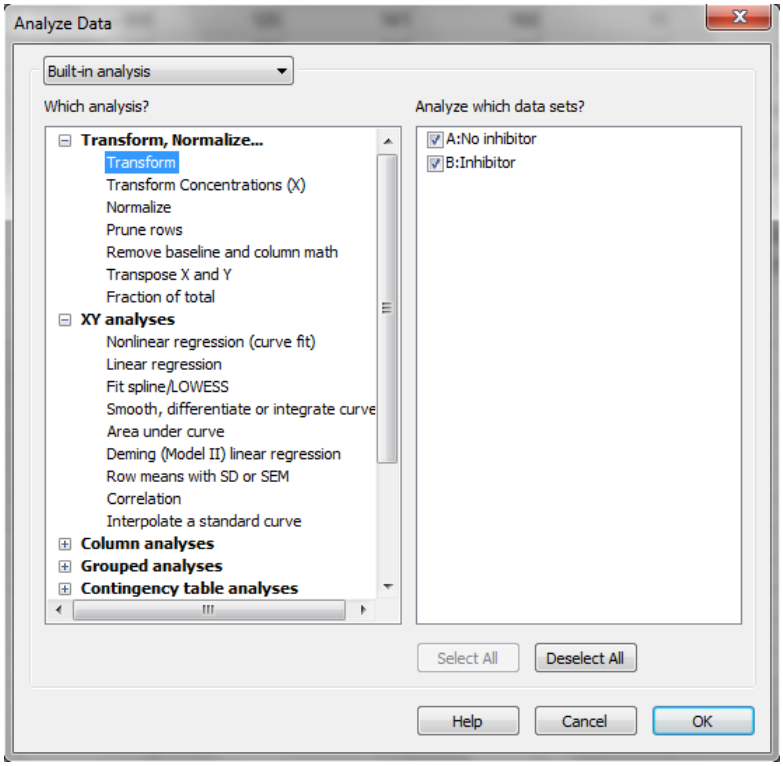
13.3.1 Key concept -- Manipulating data

Before graphing or analyzing your data, you may first need to do some calculations to get your data into proper form. While Prism is not as versatile as Excel, Prism can do many data manipulations. From the data table, click Analyze on the toolbar, and choose transform 318 , normalize 325 , transpose 327, prune 328 or remove baseline 323.



Results will appear on a new results tab with a green grid. While you cannot edit these results, you can create a new graph (use the New... button) and do further analyses (click the Analyze button).

What if Prism doesn't offer the tools you need to manipulate your data? In that case, you should enter and manipulate your data in Excel, and then copy and paste the results into Prism for further analysis and graphing. Note that you can paste a link to the Excel file or you can paste embed the entire Excel workbook within Prism. Learn more about linking and embedding data from Excel 270.

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13.3.2 Transform data

When you transform data with Prism, the data table isn't changed. Instead, Prism creates a new results table with the transformed values.

Standard functions

Choose a function

Choose from one of these functions for transforming Y values (analogous functions are available for X):

Function	Comments
Y= Y * K	Enter K in the box provided.
Y = Y + K	"
Y = Y – K	"
Y = Y / K	"
Y = Y squared	Enter K in the box provided.
Y = Y ^ K	
Y = log(Y)	Log base 10
Y = -1*log(Y)	Natural logarithm (base e)
Y = ln(Y)	Ten to the Yth power (inverse of log).
Y = 10 ^ Y	e^Y (inverse of ln)
Y = exp(Y)	
Y = 1/Y	Square root.
Y = sqrt(Y)	ln(Y/1-Y)
Y = logit(y)	Y must be between 0.0 and 1.0. See notes below.
Y = probit(Y)	Column rank. Smallest Y value gets rank of 1.
Y = rank(Y)	Number of SDs from the column mean.
Y = zscore(Y)	Y is in radians.
Y = sin(Y)	"
Y = cos(Y)	"
Y = tan(Y)	Result is in radians.
Y = arcsin(Y)	Absolute value.
Y = ABS(Y)	Gaussian. Mean=0. SD=K (you enter).
Y = Y + Random	
Y = X / Y	
Y = Y / X	
Y = Y – X	
Y = Y + X	
Y = Y * X	
Y = X – Y	
Y = K - Y	Enter K in the box provided.
Y = K/Y	"
Y = log2(Y)	Logarithm base 2
Y = 2^Y	2.0 to the power of Y
Y = Y rounded to K digits after decimal	

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Many of the functions include the variable "K". Enter a value for K on the dialog. When transforming Y values, you can enter one value of K for all data sets or a separate value of K for each data set. To enter different K values for each data set, choose a data set, enter K, choose another data set, enter its K, and so on. Rather than entering the value of K, you can hook an analysis or info constant 306.

Notes about the probit() function. Prism uses an older definition of probit that adds 5 to all results, to avoid use of negative numbers. No, it doesn't really make sense, but this was once a common standard. So probit(0.025) = 3.04 (which is -1.96 + 5.00), probit (.975) = 6.96 (1.96 + 5.00), and probit(0.5) = 5.00 (0.00 + 5.00).

Interchanging X and Y

When you choose a standard function, you can choose to interchange X and Y values and also choose transforms of X or Y or both.

Some notes on swapping X and Y values:

- Prism can interchange data on tables with more than one data set (more than one Y column), even though the results sheet has only a single X column. It does this by creating additional rows. The results will be staggered down the page with only one data set in any particular row.

- If you entered replicate Y values (or mean with SD or SEM) Prism interchanges X and Y by putting the mean Y value into the X column. Information about the scatter of Y is ignored.

- If you selected X or Y transforms (in addition to interchanging), Prism applies the transform to the data after interchanging X and Y. This means that the X transform is applied to data that were originally in the Y column, and the Y transform is applied to data originally in the X column.

Transforming error values

If you entered replicate Y values, Prism can transform each replicate or the mean of the replicates.

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If you entered data as mean, SD (or SEM), and N, Prism tries to transform the error bar as well as the mean. When a transform is intrinsically asymmetrical (i. e. logarithms), it is mathematically impossible to transform a SD and end up with a SD. You have two choices. You may either transform the mean only or erase the error bars. Or you may convert the error bars to 95% confidence intervals, and then transform both ends of the confidence interval. The resulting 95% CI will be asymmetrical.

Transforms for pharmacology and biochemistry

Eadie-Hofstee, Hanes-Woolf, and Lineweaver-Burk transforms are used to plot enzyme-kinetic results. Scatchard transforms are used to display radioligand binding, and Hill plots are used to plot dose-response data.

Important:. Use these transforms only as a way to display data, not as a first step in analyzing data. You'll get better results by using nonlinear regression on the actual data.

Here is the mathematical definition of each transform:

Function	X becomes	Y becomes
Eadie-Hofstee	Y/X	No change
Hanes-Woolf	No change	X/Y
Hill	No change if you entered your data as log(conc.). Log10(X) if you entered your data as concentration.	log10(Y/(Ymax-Y)) (Prism prompts for Ymax)
Lineweaver-Burk	1/X	1/Y
Log-log	Log10(X)	Log10(Y)
Scatchard	Y	Y/X

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Prism can also create Bland-Altman plots, which require a simple transform of the data. However, this is not done via a transform, but rather via a separate analysis.

User-defined transforms

When writing your transform, you may use any of these functions when writing your equation. Mostly functions are pretty standard. Beware of the sqr() function, which has different meanings in different environments. In Prism, sqr() squares the value, and the sqrt() function takes the square root.

If you are transforming X values, you may use Y in the function. If the data table contains several data sets (so has several Y values for a single X value), Prism will stagger the results down the page, repeating X values as needed. The results for column A will appear on top of the results table. Below that Prism will place the results for column B. For these rows, column A will be empty.

Usually, the same function is applied to all data sets. But you can write a transform to apply different transforms to different data sets. To do this, precede the lines that apply to only some data sets with column designators. For example, put <B> in front of a line in your transform that only applies to data set B. Put <~A> in front of a line that applies to all data sets except data set A.

Prism allows you to introduce some branching logic through use of the IF function. The syntax is:

```
IF (conditional expression, value if true, value if false)
```

You can precede a conditional expression with NOT, and can connect two conditional expressions with AND or OR. Examples of conditional expressions:

```
MAX>100
Ymax=Constraint
(A<B or A<C)
NOT(A<B AND A<C)
FRACTION<>1.0
X<=A and X>=B
```

Note: "<>" means not equal to, "<=" means less than or equal to, and ">=" means greater than or equal to. Here is an example:

```
Y= IF (Y<Y0, Y, Y*Y)
```

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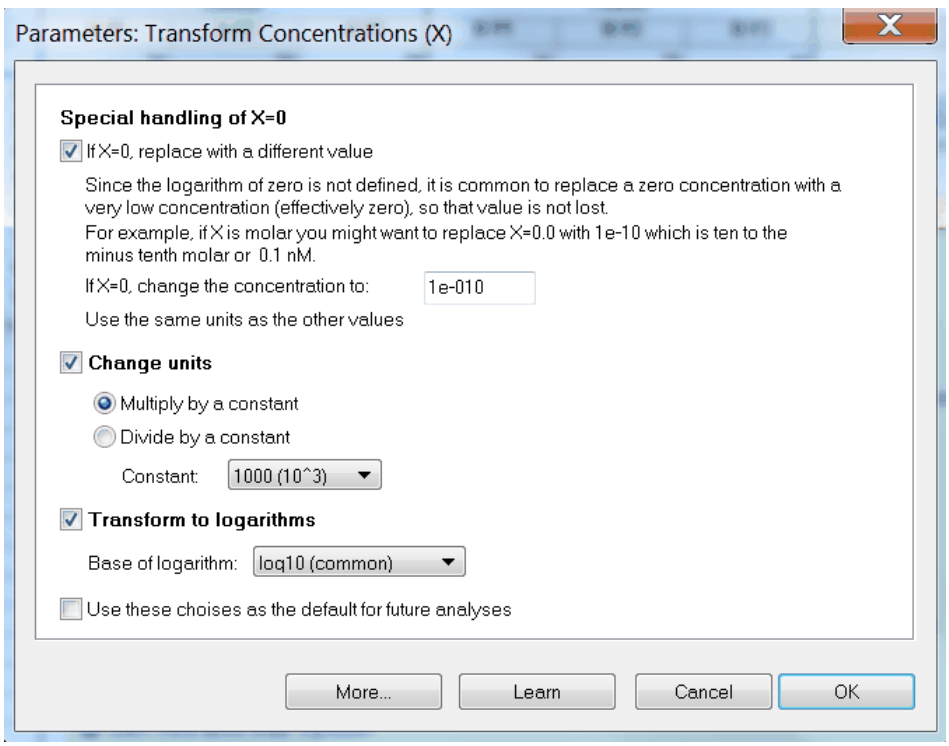
If Y is less than Y0, then Y is unchanged. Otherwise Y is transformed to Y squared.

```
Y = IF (Y<0, Y/0, Y)
```

This function returns Y if Y is positive or zero, but otherwise leaves the results blank. In other words, it removes all negative values. The way to leave a result blank is to do an impossible mathematical transform such as dividing by zero.

13.3.3 Transforming concentrations

This analysis makes it easier to transform X values that are concentrations.



Special handling of X=0

Why handle X=0 specially? Because it is common to transform X values to their logarithms, which is required before fitting some models to your data. Since the logarithm of zero is undefined, if you enter X=0 that value will be empty (missing) after transformation. This analysis lets you substitute some other value (a tiny concentration) for zero before taking the logarithm. For example if your data go from 10^{-9} to 10^{-3} molar and you plan to take the logarithm, consider changing the 0 value to 10^{-11}.

Change units

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Multiply or divide all X values by a constant you select to change units.

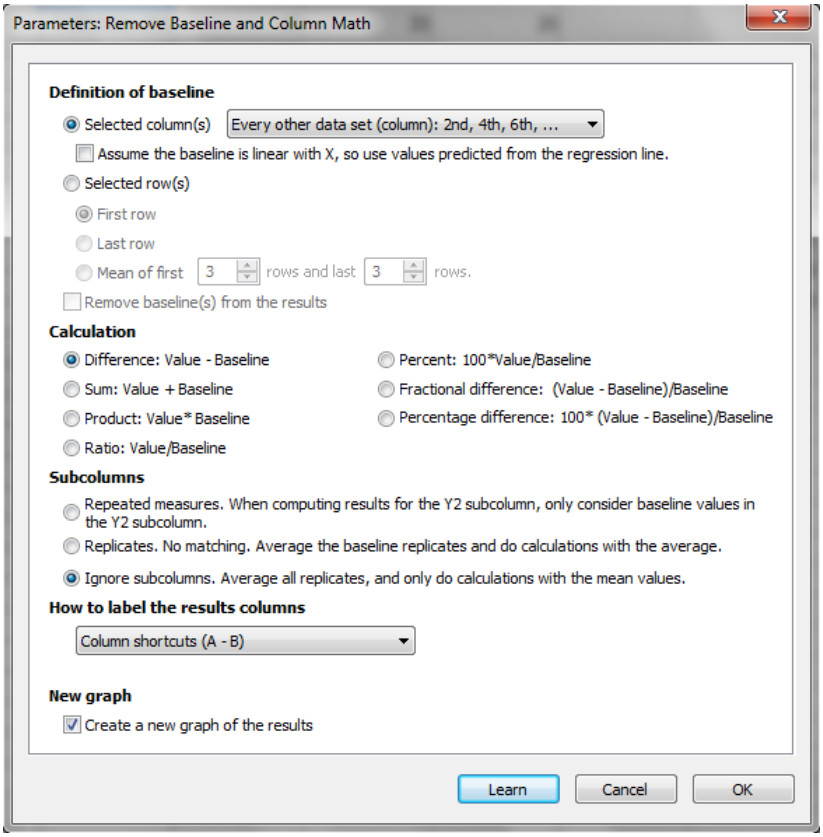
Transform to logarithms

Choose whether you want to use natural logarithms or base10 common logarithms. Unless you are a mathematician, you may only know about common logarithms and "natural logarithms" will seem very unnatural.

13.3.4 Remove baseline

Many kinds of data combine a measurement (signal) you care about with a baseline or background (noise) you don't care about. You can analyze these data using two approaches. One approach is to perform analysis on the total signal. The other approach is to subtract or divide by a baseline or nonspecific value and then analyze and graph the results.

To access this analysis, start from the data table, click Analyze, then chose the analysis Remove Baseline and Column Math. If you can't find what you want in the analysis, take a look at the Normalize analysis 325 which does similar calculations.



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Definition of baseline

Depending on the experimental details, the baseline can be defined in (at least) three ways. Think this through before choosing this analysis in Prism. The baseline value for a particular value can be:

- A value, or the mean of several replicate values, in specified rows of the same column as the total value. Choose to define the baseline as the value in the first row, the last row, or the mean of a specified number of values in the first and/or last rows.

- A value (or mean of replicate values) in the baseline column of *the same row of the table* as the value from which the baseline will be subtracted (or divided) . So the baseline value for a value in row 13 of column B would be the value in row 13 of column A, or the mean of replicate values in row 13 of column A. Choose between a single column being the baseline values for all other values, or of having every other column be baseline vs. total.

  If you check the option to assume a linear baseline, Prism performs linear regression using the X values as X and the background (nonspecific) values as Y. It computes a predicted Y value (from the line) at each value of X. Finally, it subtracts (or divides) this predicted baseline Y value. This method is appropriate when you know that the nonspecific or background values must be linear with the X values (for example nonspecific binding is often linear with ligand concentration), and is particularly useful when you have not collected baseline or nonspecific measurements at every value of X (Prism will fill in the missing nonspecific values from linear regression). When Prism fits linear regression, it does not assume that the line goes through the origin and does not display the regression results.

- The mean of all the values in (say) column A. You need to approach the calculation differently if you wish to define the mean (or median) of one column to be the baseline to subtract from (or divide into) all the other values,. You cannot accomplish this goal using Prism's Remove Baseline analysis. Instead, do two analyses of your data table. First do a Descriptive Statistics analysis to compute the column means. Then do a Transform analysis, and choose the transform Y = Y-K (or Y = Y/K). Hook 306 the value of K to the mean of the column you wish to use as the baseline (usually the first column).

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Calculation

The choices are self-explanatory. You can ask Prism to subtract the baseline, divide by the baseline, compute the fractional or percentage difference, etc. Note that you can also use this analysis to add or multiply two columns.

13.3.5 Normalize

Normalize the data to convert Y values from different data sets to a common scale. If you can't get Normalize to do what you want, take a look at the Remove Baseline analysis 323 which can do some kinds of normalizing.

One example of where normalizing can be useful: Investigators who analyze dose-response curves commonly normalize the data so all curves begin at 0% and plateau at 100%. If you then fit a sigmoidal dose-response curve to the normalized data, be sure to set the top and bottom plateaus to constant values. If you've defined the top and bottom of the curves by normalizing, you shouldn't ask Prism to fit those parameters.

To normalize, click Analyze and choose Built-in analyses. Then select Normalize from the list of data manipulations to bring up this dialog.

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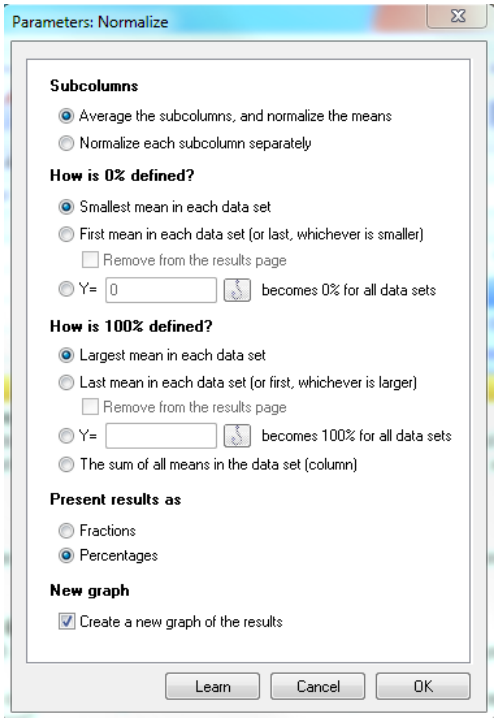

To normalize between 0 and 100%, you must define these baselines. Define zero as the smallest value in each data set, the value in the first row in each data set, or to a value you enter. Define one hundred as the largest value in each data set, the value in the last row in each data set, a value you enter, or the sum of all values in the column. Prism can express the results as fractions or percentages.

Notes:

- If you have entered replicate values, zero and one hundred percent are defined by the mean of the replicates. It is not possible to normalize each sub column separately.

- The X values are copied to the results table. They are not normalized.

- Each SD or SEM is normalized appropriately. Subtracting the baseline does not affect the SD. Dividing by the range does affect the SD, so the resulting SD values are the original values divided by the range (and maybe converted to a percentage).

- If you normalize to the smallest and largest value in the data set, you can remove those values (which would become 0.000 and 1.000) from the results.

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- If your data are entered into subcolumns, you can normalize the means or separately normalize each subcolumn.

13.3.6 Transpose rows and columns

Each row of Y values becomes one column (data set) in the results table. The first row becomes the first data set, the second row becomes the second data set, etc. You may not transpose a data table with more than 104 rows, because Prism cannot create a table with more than 104 columns.

The column and row titles in the results table are determined by your choices in the dialog.

Don't forget to check the option box if you want to create a new graph from the transposed data.

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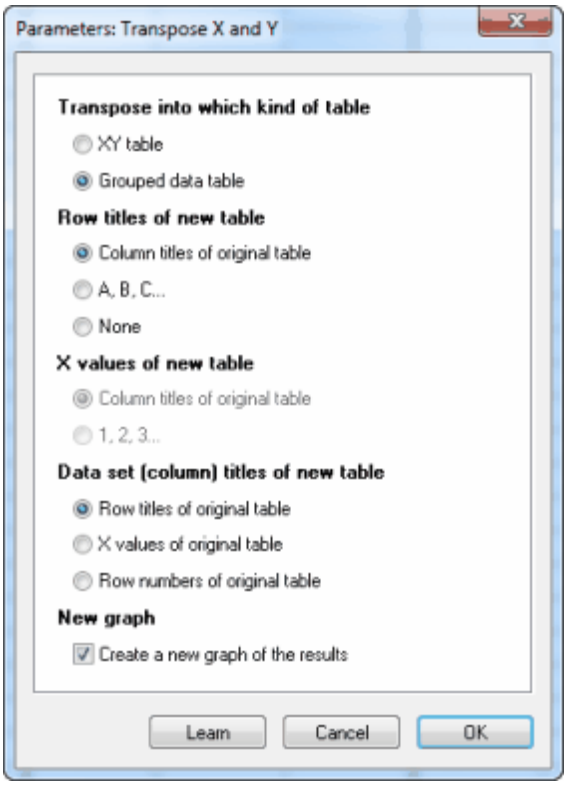

An alternative way to transpose is to copy selected data, and then paste transpose 270.

Don't confuse transposing a data table (making each row become a column) with swapping X and Y columns (so X becomes Y, and Y becomes X). If you want to swap (interchange) X and Y columns, this is possible via a checkbox on the Transform 318 dialog.

13.3.7 Prune rows

This analysis takes a large table, and creates as output a smaller table, which can be easier to work with. But note that your original data are still part of the file, which means the project file gets larger not smaller. But it can be useful to have a smaller data set for quicker analyses and graphing.

To prune, click Analyze and choose Built-in analyses. Then choose Prune from the list of data manipulations to bring up this dialog.

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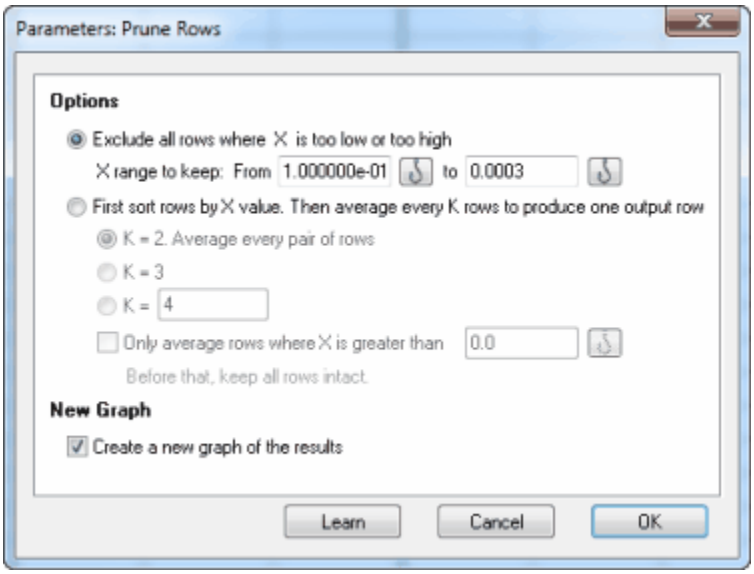

Note that Prism can also decimate while importing data 282 – import a row, skip K rows (you enter K), then import another row.

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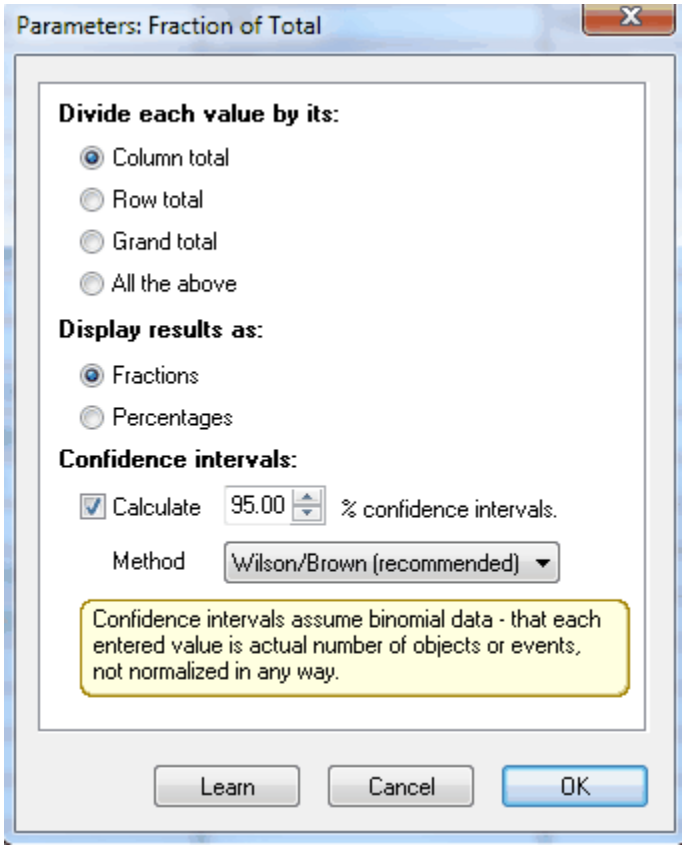
13.3.8 Fraction of total



The fraction of total analysis divides each value by its column or row total, or by the grand total.

This analysis is most often used for parts-of-whole data or for contingency tables, but it can be used for column data and for XY or Grouped data tables, so long as they have no subcolumns.

The calculation of confidence intervals only makes sense when each value entered into the table is an integer that represents the actual number of objects or events counted. In this situation, computing a confidence interval based on the binomial distribution makes sense. Don't check the option to compute confidence intervals if the data are measured values, or percentages, or normalized.

With the first three choices, the results are presented on a results table with green grid lines, so those results can be plotted. With the last choice (presenting fraction of all three totals), the results are on a table with red grid lines so cannot be plotted. With this last option, the option to report confidence intervals is not available.

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Prism can compute the confidence intervals of proportions using three different algorithms. We recommend the Wilson/Brown method. Prior versions of Prism used the Clopper-Pearson method.

13.3.9 Select and transform multiple variable tables

This analysis lets you make a new multiple variable table from an existing one. You can select just a portion of the table, and can do transforms to make new variables. You may then want to perform multiple regression (or show the correlation matrix) on the newly created table.

The dialog has three tabs.

Transform columns

On the top half, specify transforms of designated variables (columns), for example logarithm or reciprocal or change units. The results will be placed in new columns.

The bottom half of the tab lets you specify equations to generate new columns by combining two or more columns.

Select rows

Select rows in three ways:

- A range of row numbers.
- Rows where a value in a particular column is greater than (or less than, or equal to) a specified value.
- Rows where the value in one column is greater than (less than) the value in another column.

If you enter choices in more than one of these sections, only rows that fit all the criteria you specied will appear in the new table.

Select columns (variables)

- Choose which variables (columns) you want to include in the new table.

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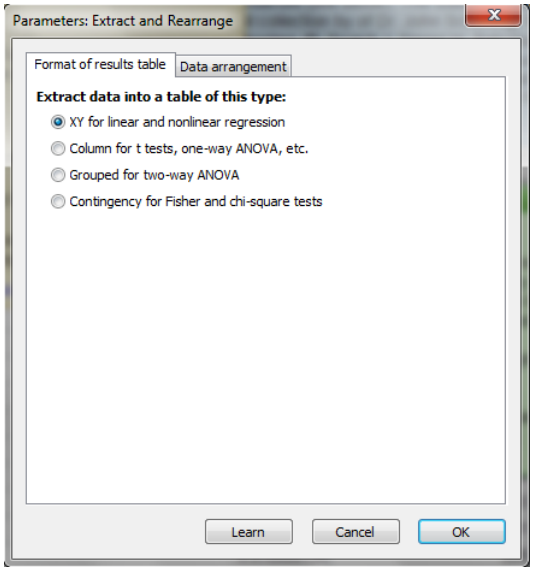
13.3.10 Extract and rearrange from multiple variable tables

This analysis takes as input a multiple variable table, and creates another table of a different type (XY, Column, Grouped or Contingency) from a subset of data. If you want to create another multiple variable table, this is the wrong analysis to use. Use this one 331 instead.

The dialog has two tabs:

Format of results table

On the first tab, decide which kind of table you want to create.



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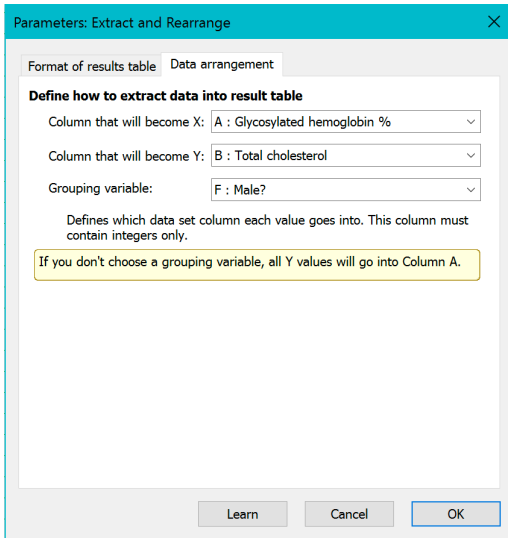
Data arrangement



On the second tab, define which columns to use.

- If you are creating an XY table, choose which column becomes the X column, which contains the Y values, and which (integers only) defines which data set the Y values go into.

- If you are creating a Column table, choose which column has all the values that will go into the new column, and which (integers only) defines the data sets.

- If you are creating a Grouped table, choose which column has all the values that will go into the new column, which (integers only) defines which data set each value goes into, and which defines which row each value goes into.

- If you are creating a Contingency table, choose which column defines the outcomes (columns) and which data set defines the exposure or treatment (rows). None of the values in the input table go into the new table. Rather the new table is a cross-tabulation table. Normally each row in the input table will increment one particular cell (defined by row and column) in the created table. Optionally, you can define another column on the input table that defines how large an increment to make.

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Note: If your goal is to swap X and Y values on a XY table, this analysis won't let you do it. Use the Transform 318 analysis instead. It has a choice to swap X and Y.

14 Graphs

For many, the whole point of Prism is to make and polish graphs. Learn how.

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14.1 Creating graphs

Automatically created graphs 335

New graph of existing data 335

Duplicating a graph 337

Graphs created by analyses 338

Portfolio graphs 338

14.1.1 New graph of new data

When you create a new data table, Prism automatically creates a linked graph.

You'll create your first data table from the Welcome (File..New) dialog, and a graph will be automatically created. When you first go the the graph, a dialog will pop up 343 where you can choose exactly the kind of graph you want.

To make additional data tables with linked graphs, click on the New button in the Sheet section of the Prism toolbar and choose New Data Table With Graph. Choose the kind of data table on the New Data Table dialog.

14.1.2 New graph of existing data

Before you create a new graph, consider duplicating 337 the graph. This is super useful.

To create a new graph of existing data:

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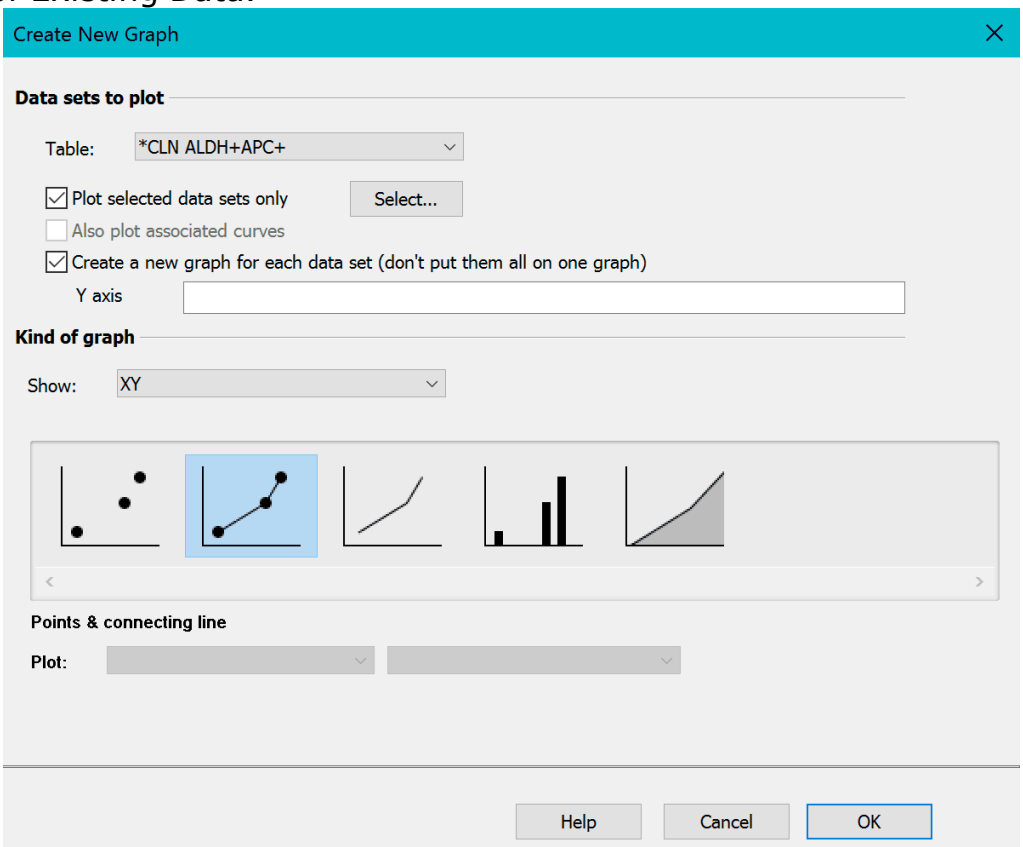
1. From the data table, click the New button and choose New Graph of Existing Data.



2. Check that the correct table is chosen in the drop-down list.

3. Check "Plot selected data sets only" if you don't want to plot all the data on the graph. Then click Select and choose the data sets to plot. You can only choose data set columns. You cannot choose a range of rows. All rows are always plotted.

4. If it is an XY table and you have fit a line or curve, check the option if you want the curve or line to also appear (as well as the data) on the new graph.

5. Usually Prism creates one graph from the entire data set. If you want one graph for each data set, check that option. If you choose to create a new graph for each data set, you can specify the Y-axis title here.

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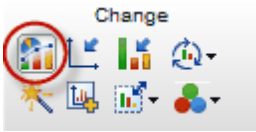
6. Choose the kind of the graph you want. The drop down lets you choose between XY, Column, Grouped, etc. graphs, but you'll almost always want the kind of graph that matches the data table.

7. Choose one of the thumbnails and make other choices to customize the graph.

To bring back this dialog, drop the Change menu and choose Graph Type, or click the button shown below.



14.1.3 Duplicating a graph

Duplicate a graph, and plot the same data

There are two reasons you might want to duplicate a graph:

- You want two graphs of the same data. Maybe one in color and one in black and white. Or one plotting raw replicates and another with mean and error bar.

- You are experimenting with different ways to graph your data. You can keep one graph while editing a copy, so exploring new ideas won't delete a graph you sort of like.

To duplicate a graph, go to it, click the New button, and choose Duplicate Current Sheet. Prism will create a duplicate of the graph, and both copies will plot the same data. Now you can change the properties of the new graph without affecting the original. In some cases, you may want to later delete one of the copies 181.

Duplicate a graph, and plot new data

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Prism offers two ways to duplicate a graph with its data table (and analyses). The two do basically the same thing, so it is a matter of preference which you use.

- Duplicate family 171. Go to the graph you want to duplicate, click the New button, and choose Duplicate Family. The duplicated graph will look identical to the one you started with, but it will be graphing a duplicated data table and perhaps duplicated analyses. Edit the data on that table, and the new graph will update.

- Clone a graph 173. Click the New button and choose New Data Table (+ Graph). On the New Data Table and Graph dialog, choose the Clone tab, and choose which graph to clone. Use tabs at the top to clone from a current project, a recent project or a saved example file 168.

When you clone a graph, you'll be asked if you want to delete the data (or part of the data) on the new data table. When you duplicate a family, you'll need to select and delete the data manually.

14.1.4 Graphs created by analyses

Some analyses automatically create new graphs. For example, if you choose to make a residual plot as part of linear or nonlinear regression, a new graph will be made. Another example: With most multiple comparisons after ANOVA, you can choose to make a new graph showing the confidence intervals of the differences between group means.

14.1.5 Portfolio graphs

One tab on the Welcome (File..New) dialog that comes up when you start a new Prism project is portfolio. Choose that tab and view dozens of graphs made by Prism. Open any of these to explore how they were made. You can also edit the data and graph to make your own graph using the portfolio graph as, essentially, a template.

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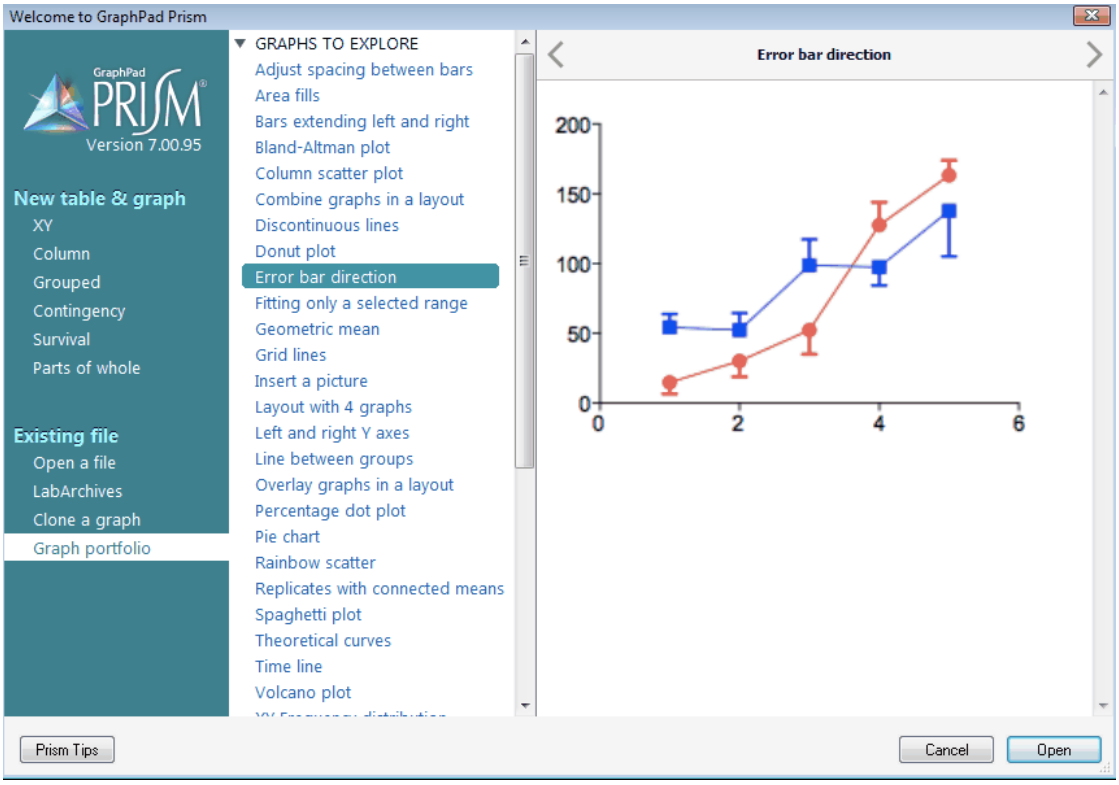

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14.2 Prism Graphs: the basics

A picture is worth a thousand words -- Prism makes it easy to create the graphs you want. Choose a type of graph, enter your data and Prism automatically creates a graph. Because

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graphs and data are linked, if your data changes your graph will automatically be updated. Once you've made your graph, you can customize any part of it. This section contains the key things you need to know to get started with graphs.

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14.2.1 Eight ways to change a graph

Direct manipulation

Click on an axis to select it. Knobs appear on both ends. Move the mouse over the right knob of the X-axis or the top knob of the Y-axis. Drag the axis to make it longer or shorter. Or grab the middle of the axis and move the entire graph around the page.

Shortcut menus

Move the mouse over a symbol, title, axis, etc, and right click (control click with Macs). The shortcut menu will give you many choices to format the object.

Change Graph Type dialog

You can bring back the Change Graph Type dialog 343 (the same one you used to create the graph) any time. This is useful for making large changes in how the graph looks.

Format Graph dialog

Use the Format Graph dialog 391 to change symbols, bars, error bars, area fills, legends, etc. Double click anywhere on the graph (except the axes) to bring it up. Be sure to look at all the tabs.

Format Axes Dialog

Use the Format Axes dialog 491 to change the range, interval, scale, numbering, etc. of the axes. Double-click on an axis to bring it up. Be sure to look at all the tabs.

Select a range of points on a data table, and change how corresponding points are graphed

Select a cell or a block of cells, right (control) click, and choose Format Points. You'll be able to change the color, size, symbol, border, etc. of the points or bars that correspond to the selected cells.

Color schemes

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Choose a color scheme 362 to change all colors at once.

Magic -- Make Graphs Consistent

The Prism Magic 347 tool makes one (or more) graph look like another. It is a huge time saver.

14.2.2 Change Graph Type dialog

Click to open the Change Graph Type dialog. On the top of the dialog, choose one of the thumbnails showing the various kinds of graphs, and then inspect the preview at the bottom of the dialog to make sure it is the graph you want.

This dialog is really designed to let you change graph type within a family. For example, change from column chart with error bars to a scatter plot. It also lets you change to a graph in a different family, but this rarely makes sense. If you need to change to a different family of graphs, there is a good chance you also need to change the format of the data table 238.

You can also change graph type within the Format Graph 420 dialog. Click Global (upper right corner of dialog), then change all data sets, so the changes you make apply to all the data sets and not just one.

Note that there are multiple ways to create bar graphs in Prism 361. Don't think "make a bar graph". Instead think about how the data are organized.

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14.2.3 Changing which data are plotted

Key points about plotting data sets

Once you understand these key points, it will be easy to control which data sets are graphed.

- A graph can include many data sets from many tables. By default, Prism makes one graph per table. But you can plot the same data table on multiple graphs, and a single graph can have data from multiple tables.

- When you fit a curve by nonlinear regression (or a line by linear regression) the best-fit line or curve is essentially a data set. Prism automatically plots the line or curve on a graph, but you can remove the curve from one graph, or plot it on other graphs. Treat the curves just as you would treat any other data sets.

- When you transform or normalize data, the results appear on green data tables. You can't edit these tables, but the data sets on green data tables can be graphed like any other.

Data Sets on Graph tab of the Format Graph dialog

The second tab of the Format Graph dialog lets you add, remove and replace data sets on the graph (and also change the front-to-back or left-to right order of data sets).

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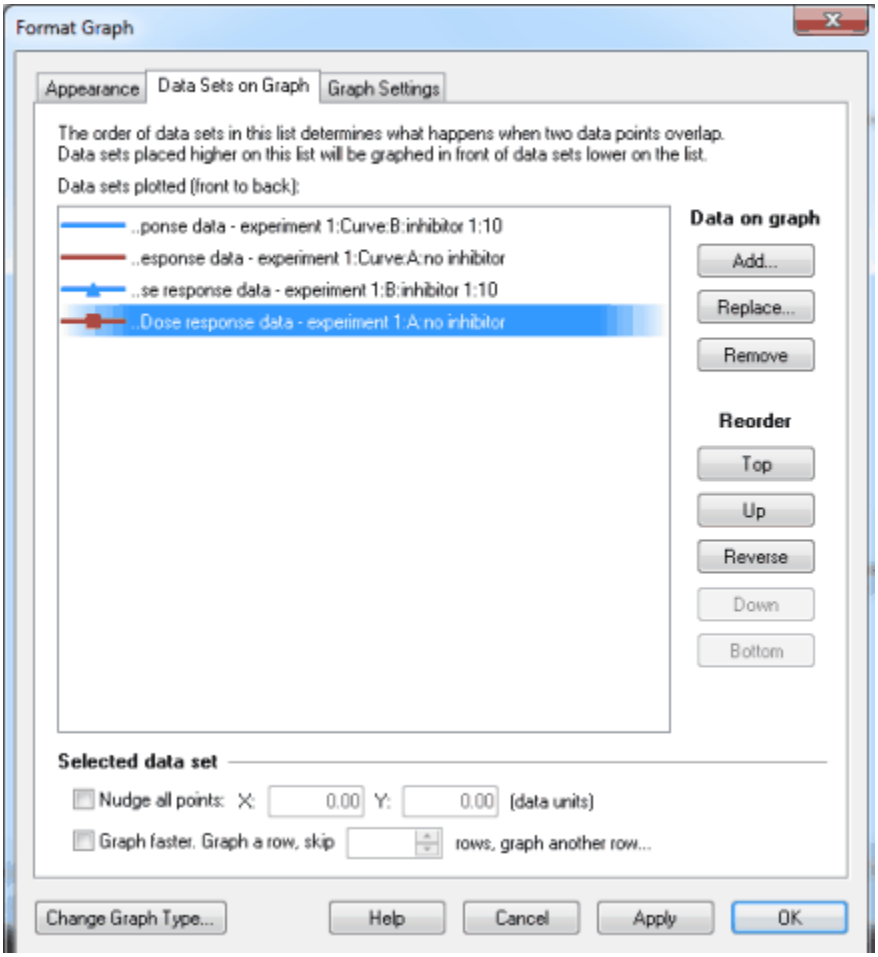
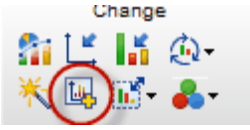


Bring up the dialog by double clicking on the graph, or using a shortcut button.



Shortcuts for adding, replacing and removing data sets

You don't need to use the dialog to add or remove data sets.

Add data to a graph by dragging a data or results table from the Navigator 146 and dropping it onto the graph.

Remove or replace a data set by right clicking on any point or bar, and choosing Remove Data Set or Replace Data Set.

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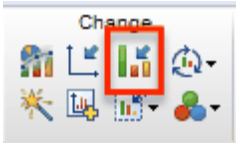
14.2.4 The Format Graph dialog

Overview

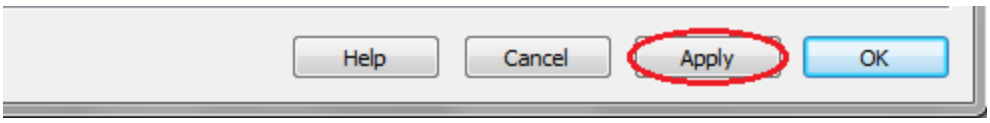
Double click anywhere on a graph (except the axis) and the Format Graph dialog will appear. Or click the Format Graph button.



The choices on this dialog 391 depend on whether you are editing a XY 399, Column 420, Grouped 439, Contingency 439, Survival 480 or Parts-of-whole 486 graph.

Click "Apply" to see the effect of changes

The Format Graph dialog gives you a huge number of options to change the appearance of your graph. Click "Apply" to see the effect of the changes you made without closing the dialog. This saves you time over clicking OK to see the changes, then bringing back the dialog to make more changes. Once you click Apply, the changes are made even if you then cancel the dialog. To reverse those changes, use the Edit..Undo command.



14.2.5 The Format Axes dialog

Overview

Double click on an axis, or drop the Change menu and chose the X-axis or Y-axis command, and the Format Graph dialog will appear. Or click the Format Axis button.

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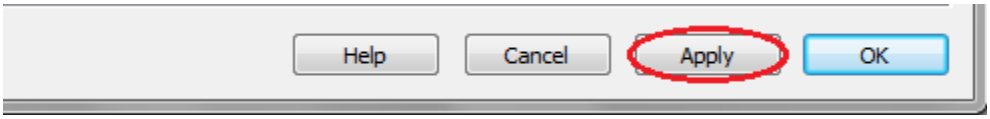
The dialog has five tabs:

- Frame and Origin 535
- X axis 491
- Left Y axis 491
- Right Y axis 358
- Titles and fonts 509

Click "Apply" to see the effect of changes

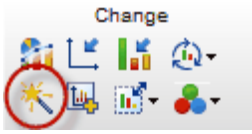
The Format Axes dialog gives you a many options to change the appearance of your graph. Click "Apply" to see the effect of the changes you made without closing the dialog. This saves you time over clicking OK to see the changes, then bringing back the dialog to make more changes.



14.2.6 Prism Magic - Make Graphs Consistent

The Prism Magic tool makes one (or more) graph look like another. It is a huge time saver.

Start from a graph, or several graphs selected in the Prism Gallery 182. Click on the Prism Magic tool in the Change section of the Prism toolbar.



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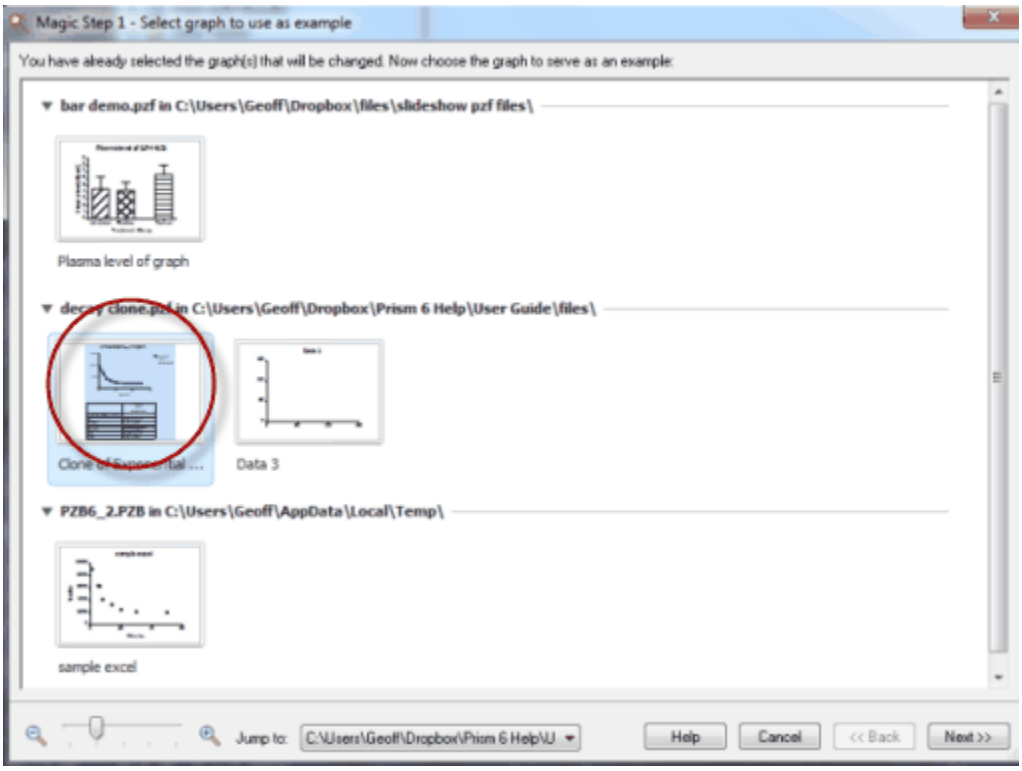
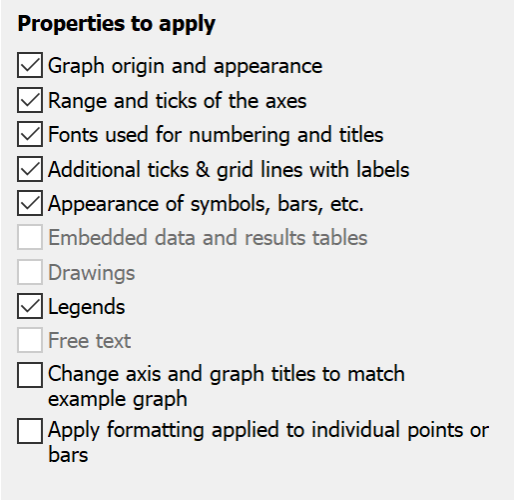
Select the graph whose appearance you'd like to match. You can choose from any graph in the current project or any open project, any graph saved as an example 173, or any graph recently (two months) printed, exported, copied to clipboard, or used as a Magic example (so long as it had been saved, so the file has a name).



Click Next, and then select the properties of the example graph you would like to apply to your current graph or graphs.



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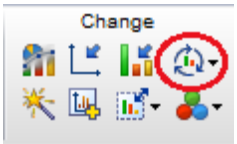
Notes:

- If you check the option "Range and ticks of axis", what Prism does depends on whether you have checked the option to use an automatic range for the axes. If that is checked (on the example graph, then Prism will check that option on the graphs you are changing. Depending on the range of the axes, they may or may not end up with the same range. If that option is not checked on the example graph, then all of the graphs you are changing will be changed to have the range and interval of the example graphs.

- Note there is one choice near the top to change the fonts (including size and color) of axis number, axis titles and graph title. There is also a choice near the bottom (introduced with Prism 8) that changes the wording of the axis and graph titles.

- The choice to apply the formatting individually applied to selected points or bars only makes sense when the example and target graphs have the same number of points of bars. If that is not the case, the choice will be gray.

14.2.7 Rotating, flipping, reversing



The Rotate/Flip button in the Change section of the Prism toolbar drops a menu with three choices. You can reverse the order of data sets on a graph, flip the page settings between landscape or portrait orientation, or rotate column graphs from vertical to horizontal

Reverse order of data sets

For XY and Survival graphs, this reverses the front to back order of data sets. This only matters when data points overlap. You can fine tune that order 405 in the Format Graph dialog.The two graphs in this example are identical except that the plotting order was reversed.

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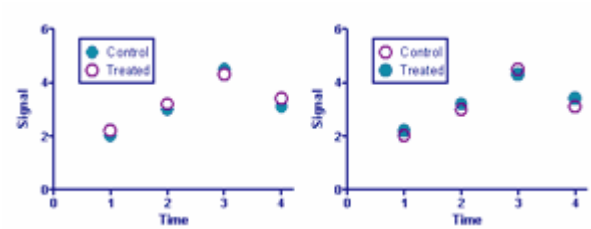


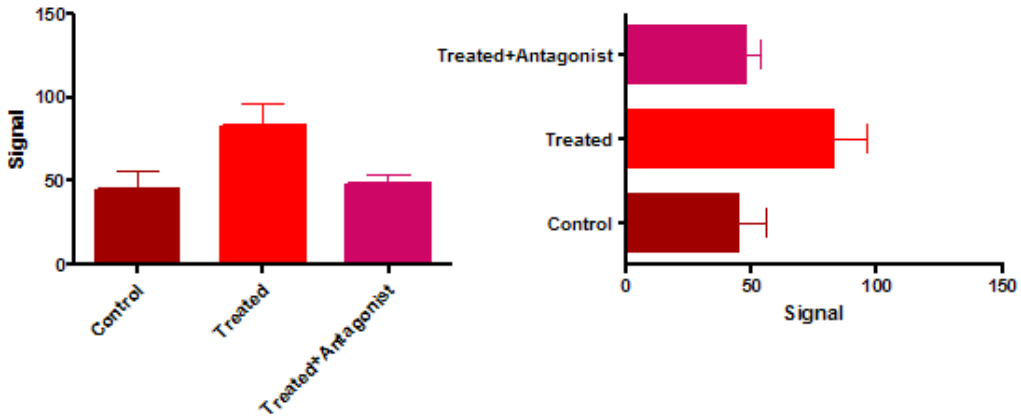
On Column, Grouped and Contingency graphs, this reverses the left-to-right order. You can also fine-tune that order 429.

Flip between portrait and landscape orientation

You choice of portrait or landscape only matters when you print the graph from the Graphs section. This choice does not change the aspect ratio 353 of the graph.

Rotate entire graphs

Rotate between vertical and horizontal presentation of Column, Grouped and Contingency graphs.



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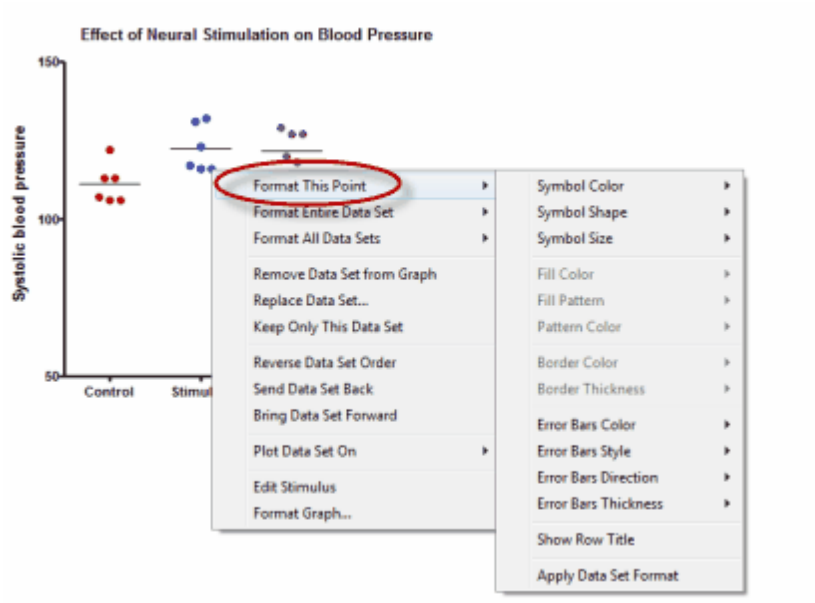
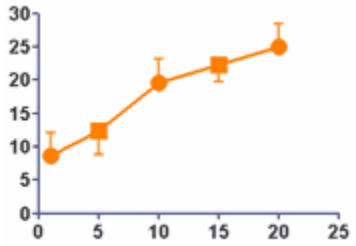
14.2.8 Formatting individual symbols and bars

Change the look of a single point or column

Right-mouse click on the point and choose Format this Point. You can change the symbol shape, size, color and the format, color and direction of the error bars.



For example, on the graph below, each data point is formatted to show different symbols and error bars directions for alternating data points.



Format a range of data from the data table

Select a block of data, right click, and choose Format Points.

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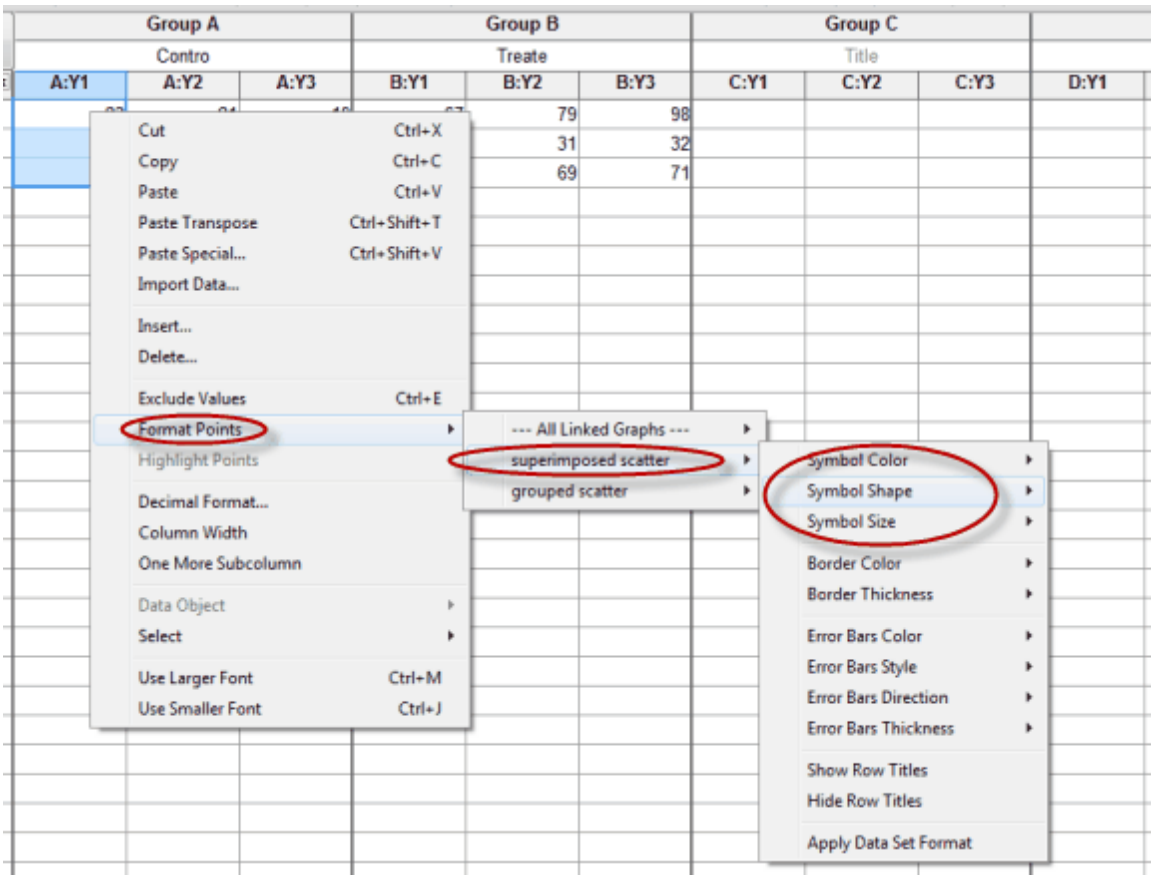

Revert individual formatting back to data set format

Open the Format Graph dialog by double clicking on the graph. Go to the Graph Settings tab, and check the option to "Remove all individual formatting."

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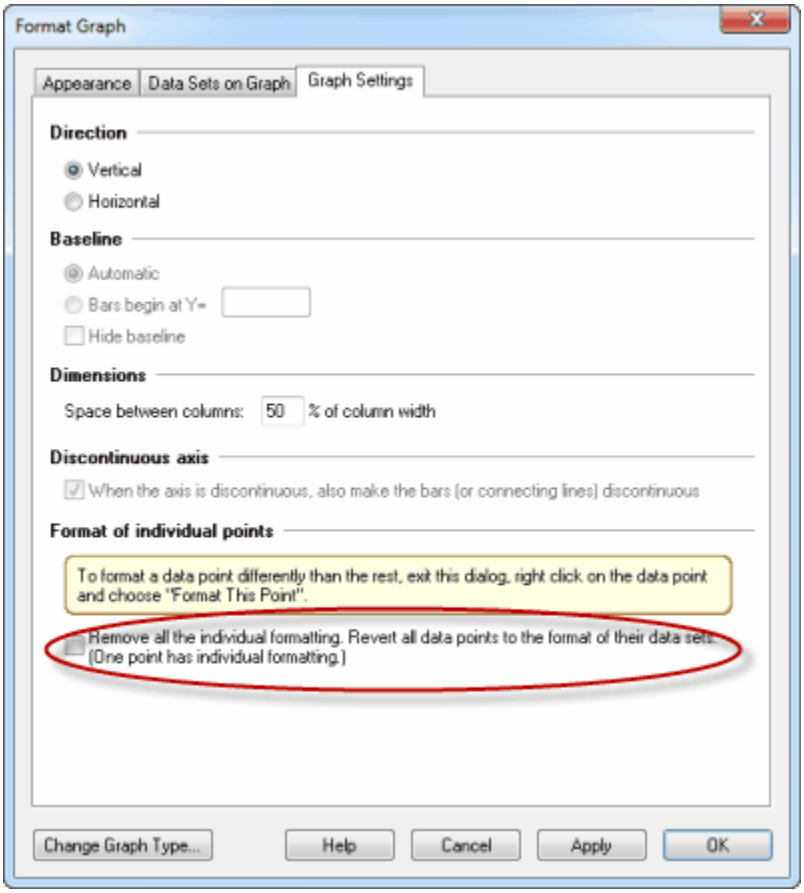
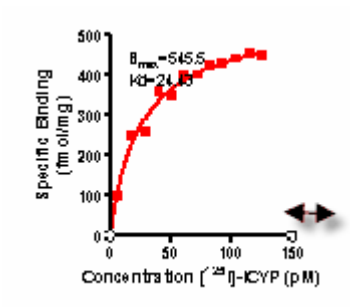


14.2.9 Changing a graph's shape and size

Stretch an axis

Click on the axis to select it. Knobs appear on both ends. Move the mouse over the right knob of the X-axis or the top knob of the Y-axis. Drag the axis to make it longer or shorter.



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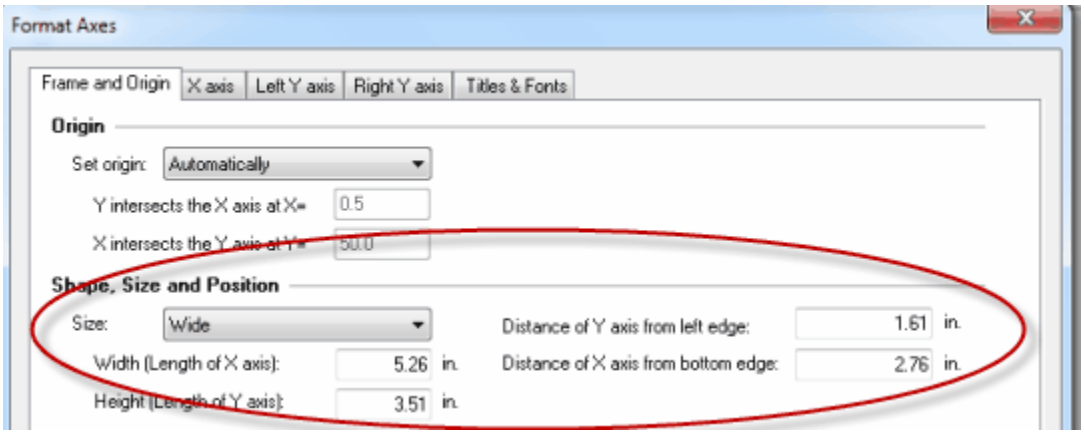
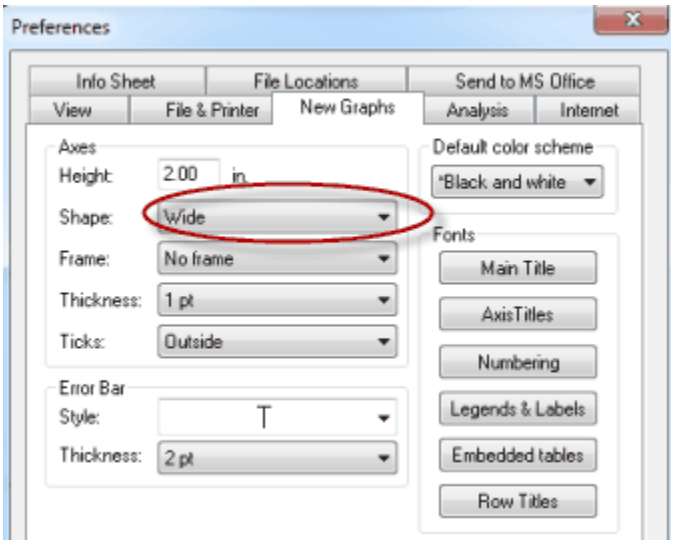
Enter the exact length of the axes

Double-click on the origin to bring up the Frame and Origin tab of the Format Axes dialog. Select a custom shape, and enter both width and height. Or select a standard (tall, square, or wide) shape, enter either height or width, and Prism will automatically change the other value. On a wide or tall graph, the long axis is 1.5 times the length of the short axis.



Set the default size and shape for new graphs

Pull down the Edit/Preferences menu and from the Graph tab choose Wide, Tall, or Square. On a wide or tall graph, the long axis is 1.5 times the length of the short axis.



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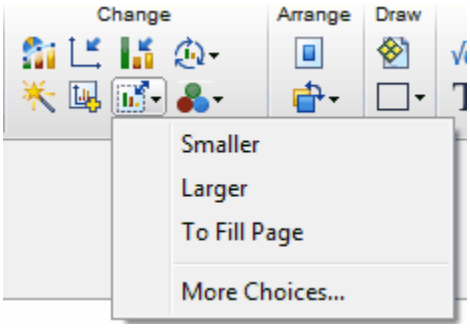
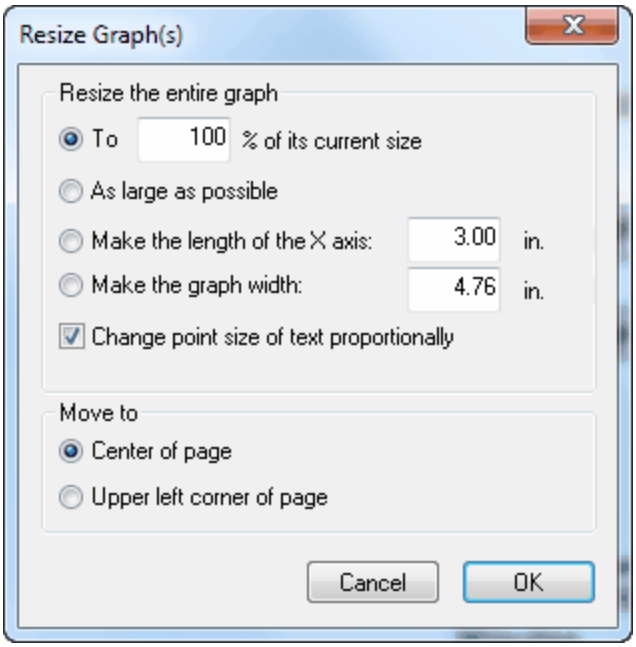
Make a graph larger or smaller, including fonts

Click the Resize Graph button in the Change section of the Prism toolbar. This button enlarges or shrinks both the graph and also the graph's symbols and fonts. In contrast, resizing by stretching an axis doesn't change symbol or font size.



If you click More Choices, a dialog lets you pick the exact size you want and lets you resize the graph without changing font size. This can be useful when the journal specifies both the exact graph size it wants and the point size of fonts.



Point of confusions

Changing the size of a graph vs. changing the zoom

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The Zoom buttons at the right end of the bottom toolbar let you zoom in or out as you work on a graph. These controls only change the magnification you see on screen, and do not change its size when printed or exported.

Changing the length of the axes vs. changing the size of the graph

The first tab of the Format Axes dialog lets you choose exactly how long the X and Y axes will be. The graph itself will be larger, depending on what you choose for numbering and titles. The graph object will also be larger if you place tables, text, drawings or images on the page.

Click the Resize Graph button in the Change section of the Prism toolbar to change the size of the entire graph object (including everything placed on the graph page). You can tell Prism to make the graph have a specified width. Or you can tell Prism how long you want the X axis to be.

You can also resize a graph when exporting 588. Specify the width of the graph (with all the other objects on the page) in the export dialog. Prism won't change the graph in Prism, but will create the exported graph file to match your choices.

14.2.10 Legends

When are legends created automatically?

When your graph includes more than one data set. If it plots only one data set, no legend is created automatically. The legend is a symbol or bar followed by the data set name. (Legends for heat maps are different 479.)

When does the legend simply say "legend"?

When you have not entered a column title. Enter a column title on the data table, and the graph legend will update.

How to edit the legend

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You can edit the column titles of the data table, or you can edit the legend directly on the graph. If you edit on the graph itself, you will lose the linkage between the column title and the legend.

When is the column title hot-linked to the legend, so edits to the column title appear on the graph?

The two are hot linked so long as you only edit the column titles. When you edit the legend itself, the link is broken. Restore it by double-clicking on the graph to bring up Format Graph dialog, go to the appropriate data set, and then check the option "Revert legend to column title".

How to delete a legend

Select it and press Delete. Or hold the Control key while selecting several legends (or lasso them all) and press the Delete key to delete them all.

You can also delete legends by unchecking the "Show legend" option at the bottom of the first tab of the Format Graph dialog.

Moving legends

Select one or more legend, and drag it around. You can also use the commands on the Arrange menu to align and equally space legends.

Reversing the order

A command on the Change menu, Reverse Legend Order flips the front-to-back or left-to-right order of data sets on the graph. You can also change the order of data sets by dragging them on the page one by one.

Master legends

Learn how to make one legend be a master legend 556 for several graphs on a layout.

XY: When does Prism give me a choice of plotting a symbol, a line or both?

When you have chosen to connect points with point-to-point connecting lines. If you plot the points from one data set and also a fit curve from another results data set, Prism won't give you the choice of having one legend with both symbol and line.

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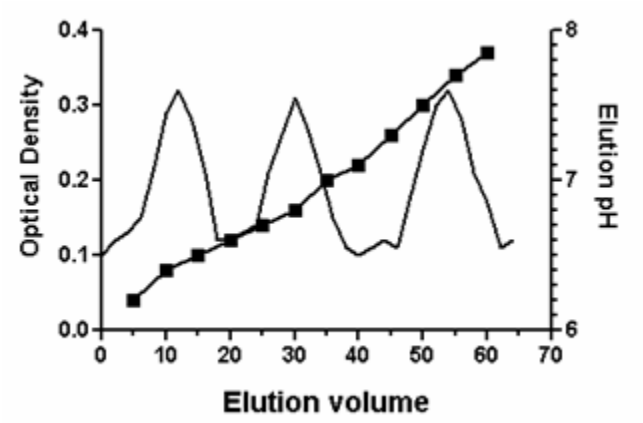
Bar graphs: How to change from square to rectangular legends for bar graphs.

Double click on the graph to bring up Format Graph. Go to the third tab, and you'll see this choice at the bottom.

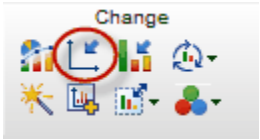
14.2.11 Graphs with a right Y-axis

When you plot several kinds of data on one graph, it is often useful to plot some data using a Y-axis on the left side of the graph and other data using a Y-axis on the right side of the graph. Note that you never can have more than one X-axis.

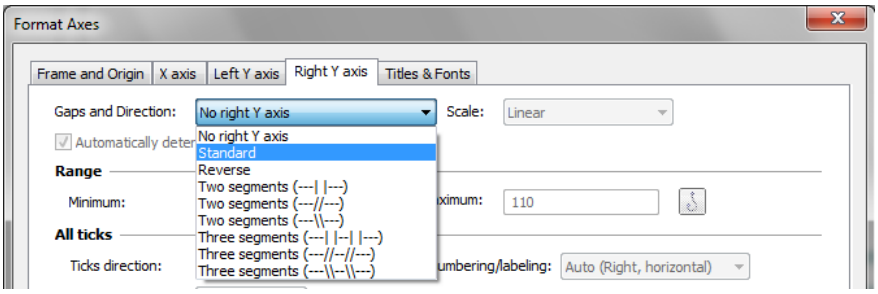


To create a second Y axis

Double-click on an axis to open the Frame and Origin tab of the Format Axes dialog. Or click on the Format Axis tool in the Prism toolbar.



Select the tab for "Right Y axis" and choose how you want the axis to be formatted.



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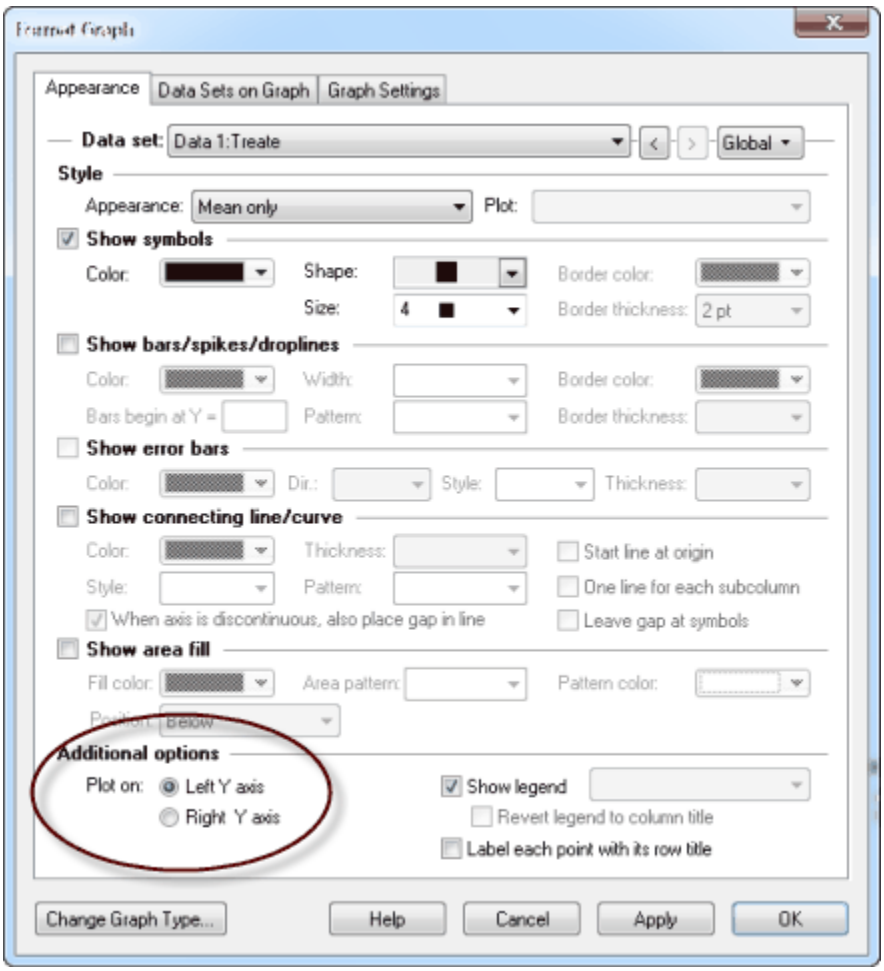
All data sets are initially graphed using the left Y-axis. Depending on the scale of the axis, the data points may or may not all be visible.

To plot data using the right Y-axis

Double-click on a data point or click on the Format Graph button on the Prism toolbar. At the bottom of the Appearance tab, select "Right Y axis". Repeat for each data set to be plotted on the right Y-axis.

If you assign a data set to the right Y-axis, and there is no Y axis. Prism will automatically create the axis.



To create a graph with ONLY a right Y axis

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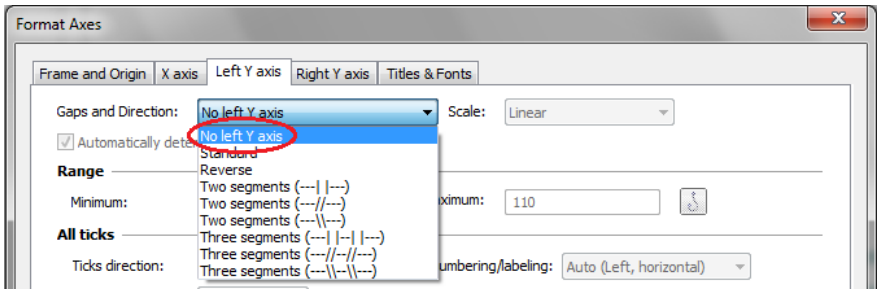
Turn off the left Y axis, and create a right Y axis to which you assign data set.



To use different colors for the two Y axes

It is possible to give the two Y axes different colors. Select one axis, drop the Change menu, choose Selected Object(s), and set the color (and thickness) on the Format Object dialog that appears.

To create a graph with three Y-axes

Prism does not allow three Y-axes. You can, however, create that effect with a bit of a workaround. Create a graph with no data. Hide the X-axis (one of the choices for axis frame). Delete all the titles, You are left with just a Y-axis. You can make that whatever scale makes sense. Now make a layout and put your real graph next to this bogus graph with only a Y axis. With some fussing to get the sizes to match, and the data scaled right, you can give the illusion you want. You'll need to tell Prism to plot all the data sets on either the right or left axis, so may need to transform your values to make this work well.

This FAQ explains in more detail.

Limitations

Prism always draws the right Y axis, if there is one, the same length as the left axis and starting and stopping at the same position on the page. If you want one of the axes to be shorter, the only way to get that effect is to cover up part of one of the axes with a drawn rectangle that you then make white (or whatever your page background color is).

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14.2.12 Changing fonts on graphs

You can change the font and point size of all the text that appears on Prism graphs:

- Set the default for fonts used in new graphs on the New Graphs tab of Preferences 191.
- The font of the graph title and axis titles can be changed by selecting the title, then changing the font using the toolbar or Change..Selected text. You can also change these fonts on the last tab of the Format Axes dialog 346.
- The font of legends is changed by selecting and changing using the toolbar or Change..selected text.
- To change the font of the axis numbering or labeling: Click once to select the axis. Then use the toolbar or change selected text to change the font of all the numbers or labels on that axis. You can also do this on the last tab of the Format Axes dialog 346.

14.2.13 Bar graphs

"Bar graph" describes how the data are plotted, but not how the data are organized. Prism can make bar graphs 224 from XY, Column, Grouped , Parts-of-whole data and nested data.

Notes:

- With XY data, you can combine bar graphs and XY on one graph 232.
- Until Prism 6, the border of a bar graph was placed half inside and half outside the bar. With thick borders, this meant the top of the border of the top part of the bar actually stuck up too high, so the bar graph did an imperfect job of displaying the data. Starting with Prism 7, the borders are placed entirely within the bars.
- Bar graphs are great for displaying proportions and counts. For continuous data, there are lots of ways to plot data. Bar graphs (in my opinion) are overused. Instead of making a bar graph, consider making a scatter plot, a box-and-whisker plot or a violin plot.

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14.2.14 Colors

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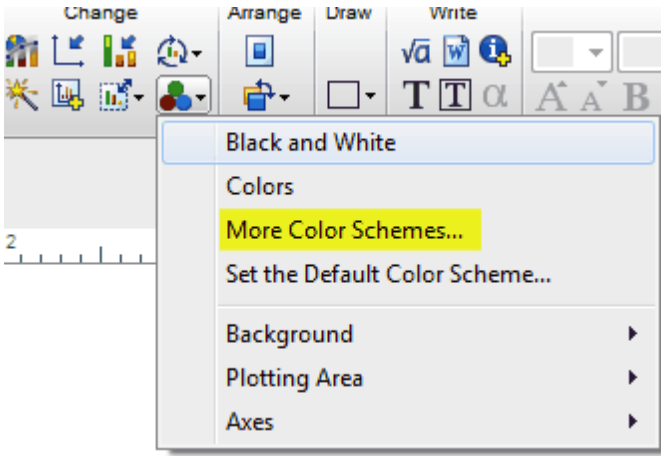
14.2.14.1 Color schemes

Color schemes change all of a graph's colors at once. They are very useful, but underused.

Go to the graph you want to change, or select several graphs in the gallery 148. Then click on the Color Scheme button in the Change section of the Prism toolbar. You can choose the Black and White or Colors schemes right from the menu, or click More Color Schemes to have more choices.



In the color schemes dialog, you can choose a color scheme by name using the drop down menu, or use the arrow buttons to browse the schemes.

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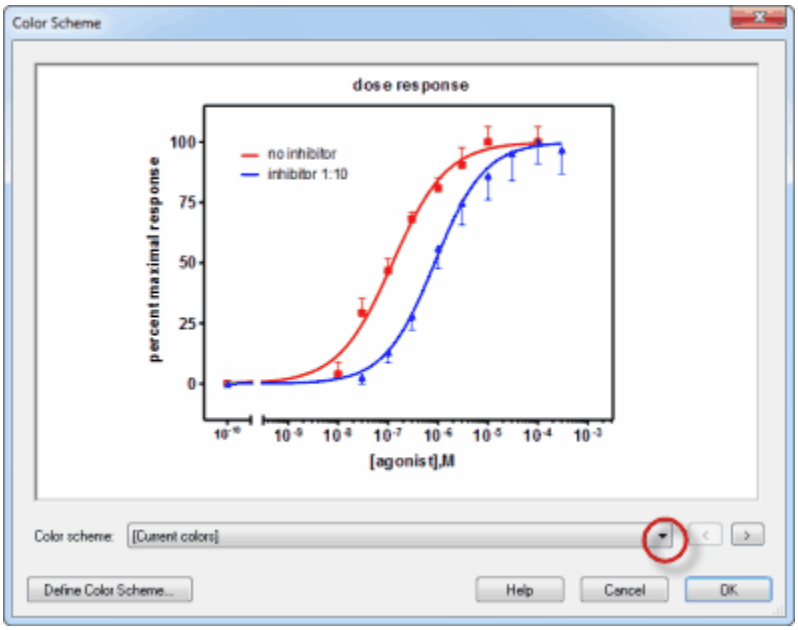

You are not limited to the color schemes we provide. To create a new color scheme, start from a graph with the colors you like. Click the Color Scheme toolbar button and choose Define Color Scheme. The new color scheme will default to the colors of the current graph, so this makes it easy to transfer a color scheme from one computer to another: Apply the color scheme to a graph on one computer, open the file on another, and create a new scheme based on that graph.

After you click the "Define Color Scheme" button shown in the screenshot above, you can also delete any user-defined color scheme you no longer use.

14.2.14.2 Selecting colors (Mac)

To change colors individually, without dealing with color schemes:

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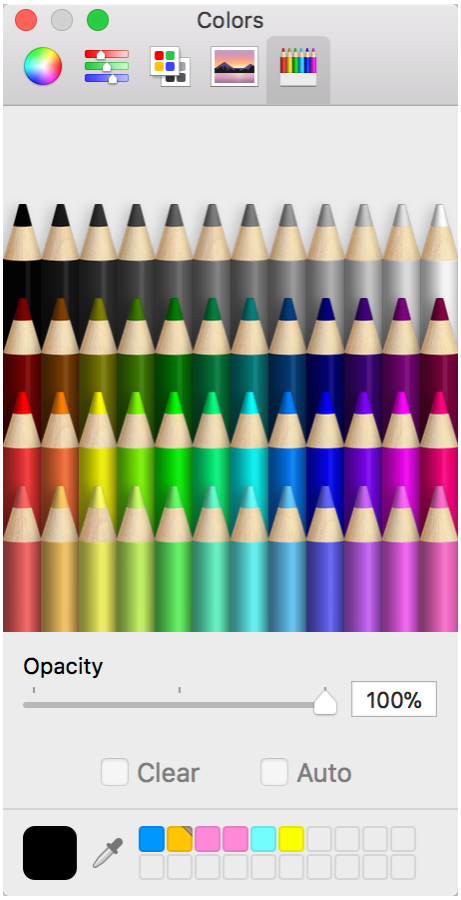
- Change the color of a data set in the Format Graph dialog. Double-click on the graph to open it.

- To change the color of just one data point, right-click on that point or bar and choose Format this data point 351

- Change the color of axes in the first tab of the Format Axes dialog. Double click on an axis to open it.

When you choose any color in Prism mac, you use the standard MacOS color picker.



- The toolbar at the top lets you choose one of five different approaches to choosing a color. The example above shows choosing from a a set of crayons, but the other button or tabss let you also use a color wheel, color sliders (to enter RGB or CMYK), list of colors, or choosing from a color palette.

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- The magnifying glass icon gives you a sixth way to choose colors, by matching a color elsewhere on your screen. Click on the icon, then click on any color showing on your screen (ok if it is a different application).

- The custom colors at the very bottom of the dialog offer a seventh way to choose a color. Simply click on the desired color. See below for adding colors to this palette.

- Once you choose a color in the color picker, you'll also see it in the Prism dialog. You don't need to click OK or close the Color Picker dialog.

- To add new colors to the custom color palette at the bottom of the dialog, drag a color down from the large swatch on top of the dialog (white in the example) and drop onto one of the custom color boxes. To choose a custom color, click on it.

- To make a color semitransparent 367 (opaque), use the slider at the bottom of the color picker.

Troubleshooting the Mac color picker

14.2.14.3 Selecting colors (Windows)

Using the color picker

Within Prism, there are color drop downs on many dialogs (Format Graph, Format Axis...) and on some right-click shortcut menus. Choose a color shown and you are done. Or click the bottom choice, More Colors. for more choices. This brings up the custom color dialog, which is part of Windows and was not created by GraphPad. This offers three ways to choose a color:

- Basic colors.

- Custom colors. See below for how to define a color to be custom.

- Use the large color picker on the upper right of the dialog. To use this, you need to make two choices. First, choose a color in the large box. Then use the vertical slider to choose the shade of the color, basically how much black is added. The slider often defaultsall the way down to

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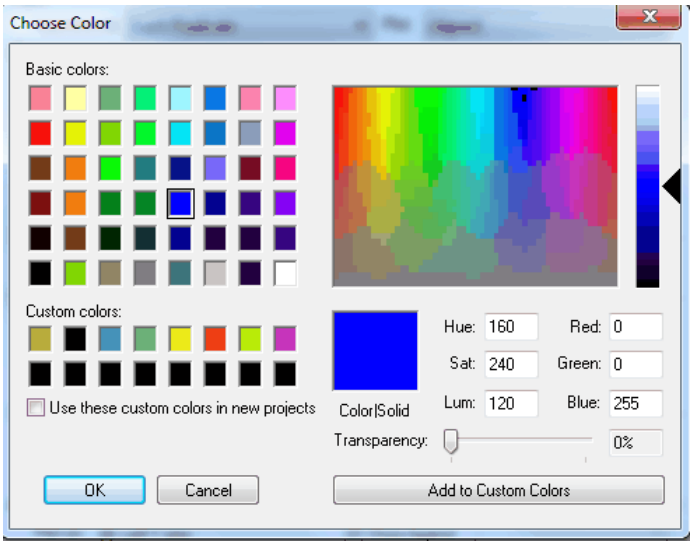
maximum blackness. In this position, all the colors look black! You'll need to move that slider up.

- Enter a color by entering three numbers representing HSL or RGB. With Windows, it is not possible to choose a color by entering CMYK values. But all colors can also be encoded as RGB.



Custom colors

There is room at the bottom left of the dialog for 16 custom colors you create. To define and save a custom color, follow these steps:

1. Make sure that "Use these custom colors in new projects" is checked.

2. Check on one of the 16 custom color boxes in the bottom left of the dialog, an empty one if there is one empty.

3. Choose a color by clicking on the large box of colors at the upper right, or by entering RGB (or HSL) values. (See the note below about the intensity slider.)

4. Click the button Add to Custom Colors. The color will appear in one of the 16 custom color boxes at the lower left, and wil stay there.

Notes:

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- The checkbox "Use these custom colors in new projects" only applies to custom colors you choose after you checked that option. It won't apply to colors you chose before checking the option.

- The colors you assign to the Custom Color slots at the bottom of the dialog cannot be transparent. The transparency of all custom colors is set to 0% (because this standard Windows dialog cannot store transparency).

- If you want to create a custom color by entering RGB (or HSL) values, you need to add a first step: click on a basic color. You'll see the RGB values of that color. Change them to enter your RGB values. Finally click "Add to Custom Colors". If you don't do that first step, you won't be successful at creating a new custom color.

Transparency

Optionally choose to make any color semitransparent 367 by sliding the control between 0 and 100%. At 0%, the color is completely opaque. No matter how light the color, objects that are underneath this object won't show through. At 100%, it doesn't matter what color you picked, because the color is invisible. In between, the color is semitransparent.

Note that semitransparent colors won't be transparent when exported from Prism to a pdf format.

14.2.14.4 Semitransparent colors

Why use transparent colors?

The main reason is shown below. When points on a graph overlap, you usually won't see some of them. If you choose a semitransparent color, the overlapping points will get darker.

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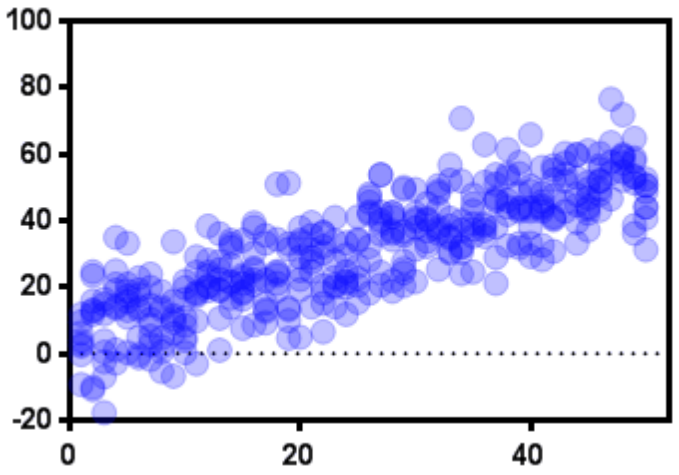

Transparent colors can also be useful when shading the area under a curve (or between error bands) so you don't hide other objects on the page.

Terminology

To be compatible with other programs, we use different terms for Windows and Mac.

- Prism Windows uses the term *transparency*. At 0% transparency, the color is completely opaque. No matter how light the color, objects that are underneath this object won't show through. At 100% transparency, the object is completely clear so it doesn't matter what color you picked. With values in between, you'll see the color you chose, but objects underneath will show through.

- Prism Mac uses the Mac term *opacity*, which is the complement of transparency. At 100% opacity, the color is completely opaque. No matter how light the color, objects that are underneath this object won't show through. At 0% opacity, the object is completely clear so it doesn't matter what color you picked. With values in between, you'll see the color you chose, but objects underneath will show through.

A transparency of 75% equals an opacity of 25%. A transparency of 40% equals an opacity of 60%.

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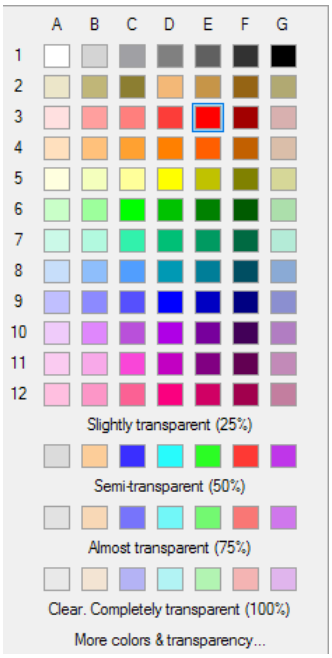
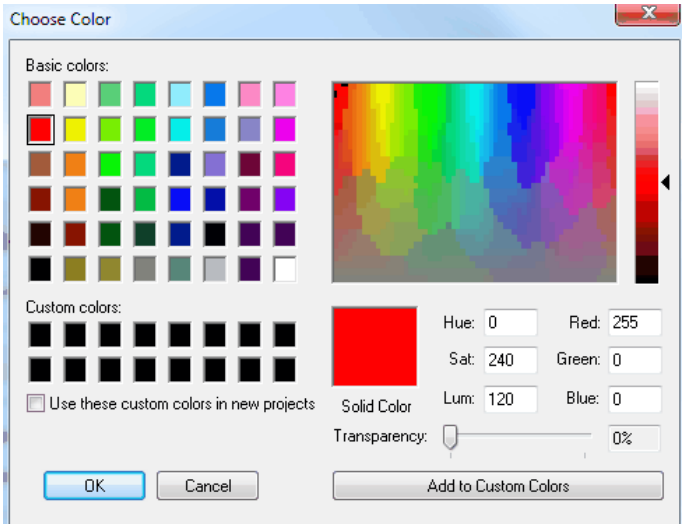
Choosing semitransparent colors

Prism Windows lets you choose a few semitransparent colors in the color drop down menu.



Or press "More colors & transparency" to bring up the full Choose Color dialog where you can choose any color and apply any degree of transparency.



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Prism Mac doesn't have the color drop down menu, so you choose opacity at the bottom of the color picker.

A semitransparent color is not the same as a light color

You can make any color with a light shade, with lots of white mixed in. But a light color is not semitransparent. Light colors are opaque. To get a color that looks light but is semitransparent, start with a darker color and choose transparency.

Semitransparent colors in exported images

When you export your graph or layout, the semitransparent/clear colors may or may not look semitransparent/clear in the exported image. It depends on what format you export in and on whether you use Prism Windows or Mac. In the table below, "Yes" means that semitransparent/clear colors will be encoded in the exported file, and "No" means they will not be.

Format	Windows		Mac	
	Semitransparent	Clear	Semitransparent	Clear
EMF	Yes	Yes	These formats are Windows only.	
EMF+	Yes*	Yes		
WMF	Yes	Yes		
EPS	No	No	No	No
PDF	No	No	Yes	Yes
TIFF	No	Yes	No	Yes
PNG	No	Yes	No	Yes
JPG	No	No	No	No
BMP	No	No	No	No

* Prism 8 only; not Prism 7

14.3 Replicates and error bars

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14.3.1 Entering replicates and error values

Prism lets you enter error values directly in a data table and plot them on a graph, or it will calculate them from raw data. You can choose what you want error bars to show and how you want them formatted.

Key 372 concept -- Replicates and error bars 372

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Horizontal error bars 377

14.3.1.1 Key concept -- Replicates and error bars

When you collect scientific data, you often collect replicate data and plot the individual replicates or an error bar showing the variability of the data. One of Prism's strengths is its ability to handle replicates and error bars.

- You can enter replicates directly into a Prism data table.
- If you enter replicate values, Prism can plot either individual replicates or error bars.
- You do not need to enter SD or SEM values in order to plot them. Prism can plot error bars from raw data.
- You do not need to run a Row Means analysis to plot error bars. Prism can plot error bars directly from raw data.

See also:

Graphing each replicate 378

Key concepts: SD

Key concepts: SEM

SD and SEM are not the same

When to plot the SD vs. SEM

14.3.1.2 Entering replicates

XY and Grouped graphs

When you create an XY or Grouped table, you can choose to include side-by-side subcolumns. For example, this table was set up with three side-by-side subcolumns:

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Table format: XY	X	Group A			Group B		
	Seconds	Control			Treated		
	X	A:Y1	A:Y2	A:Y3	B:Y1	B:Y2	B:Y3
1 Title	1	35	31	42	36	39	25
2 Title	2	43	49				
3 Title	3	50	57	67	87	89	62
4 Title	4						
5 Title	5	77	89	99	102	145	154
6 Title	10	145		121			
7 Title	15				254	269	231
8 Title	20	167	187	145			
9 Title	25				289	296	271
10 Title							

Prism can plot the raw data (each replicate) or can plot error bars it computes. You don't need to run any analyses to compute the SD or SEM (etc.). Prism does the calculations itself and plots the error bars.

Column graphs

Replicates are entered into a stack in each column. There are no subcolumns.

	Group A	Group B
	Placebo	Active Drug
	Y	Y
1	45	67
2	23	46
3	56	113
4	76	79
5	81	123
6	87	
7	99	

Nested graphs

Replicates are stacked into each subcolumn.

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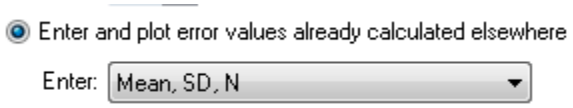
	Group A			Group B		
	Teaching method A			Teaching method B		
	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6
1	21	18	35	26	38	31
2	26	25	28	34	44	41
3	33	26	32	27	34	34
4	22	24	36		45	35
5		21	38		38	38
6		25				46
7						

Note the big difference between nested and grouped tables. Replicates are placed on side-by-side subcolumns on Grouped tables, but are stacked in a subcolumn on a Nested table.

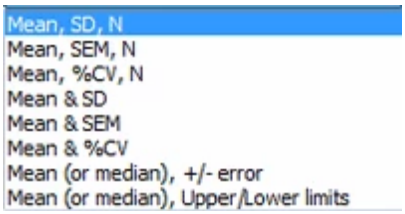
14.3.1.3 Entering error values computed elsewhere

Choosing to enter precalculated error values

When creating (or reformatting) a Grouped or XY table, you can choose to format the table for entry of preaveraged data.



Here is the list of choices:



If you enter mean and SD or SEM, why also enter n?

If you only want to make a graph showing mean and SD or SEM, you only need to enter those values into the data table. It is ok to omit the "n"

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values, or to format the table for entry of Mean with SD or SEM, but without n.

It is necessary to enter n in these situations:

- You want to be able to switch between graphing SD, SEM and CI error bars. If you enter SD or SEM with n, Prism can switch between plotting whatever form of error value you want to show.

- You want to do statistical analysis. t tests, ANOVA and more require knowing sample size.

- You want accurate nonlinear regression. If you enter the data as mean and SD or SEM, Prism will fit the means, and ignore the values you enter as SD or SEM. If you also enter n, Prism can account for scatter and sample size, and the curve fit will be the same as if you had entered raw data.

What is the %CV?

The %CV is the coefficient of variation as a percentage, so is defined as 100*SD/Mean. Since the SD and Mean are in the same units, the %CV is a unitless percentage. This is only useful for ratio variables, where zero means none of that value. Weight is a ratio variable, because a weight of 0.0 means no weight. Temperature in C or F is not a ratio variable, because a temperature of 0.0 doesn't mean no heat.

The difference between entering +/- errors and upper/lower limit errors

It is easy to confuse the +/- and upper/lower choices for entry of preaveraged data. But the two are distinct.

- When you format the subcolumns for entry of +/- error values, the values you enter are interpreted as distances. These are added to (or subtracted from) the value you enter as the mean to compute the end point of the error bars.

- When you format subcolumns for entry of upper/lower Limit error values, the values you enter are interpreted as the end points of the error bars. The error bars will end at the Y values you enter.

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What if I want to enter the median and quartiles, or some other kind of error bars?

If you choose to enter the mean, with sample size (n) and SD, SEM or % CV, you really ought to enter those exact values. Otherwise, analyses might be incorrect.

If you choose to format the data table with subcolumns for Mean and SD or SEM or %CV without sample size, or for mean with +- error values or upper and lower limits, no analyses will be possible. Or rather Prism will only analyze/fit the means and ignore the error values. If you choose to format the table so the subcolumns are labeled mean, upper limit, and lower limit, you are welcome to enter into those subcolumns the median plus the 25th and 75th percentiles, or whatever values you want. Prism will plot the error values you enter, and it is up to you to keep track of how these values were actually calculated, and to label your graphs accordingly.

14.3.1.4 Error bars and confidence bands on Survival graphs

Survival tables offer no choices for data entry

When you create a survival table, you have no choices for data entry. You don't enter error values. Instead, Prism computes the SE or 95% CI of survival when it creates the survival curves from raw survival data. Learn more about entering survival data 216.

If you want to enter survival fractions with SE values computed elsewhere, create an XY graph. In this case, Prism will not be able to compare survival curves.

Survival graphs can include error bars computed as standard errors or as confidence interval. To change: Double-click anywhere on the graph to bring up the Format Graph dialog and then go to the third "Graph Settings" tab.

If you plot the 95% confidence interval as confidence bands, you can fill or color the area between the bands.

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14.3.1.5 Horizontal error bars

There are three approaches to having horizontal error bars in Prism.

XY graphs with X error values

In the Welcome (File..New) dialog, or using Format Data Table, you can ask Prism to create a subcolumn for X error bars.

Table format: XY	X		Group A	
	X Title		Title	
	X	Err. Bar	A:Y1	A:Y2
1 Title				
2 Title				
3 Title				
4 Title				

Prism will then plot each point with horizontal X error bars sticking in each direction a distance defined by the X error value you entered. It is not possible to tell Prism to only plot the error value in one direction.

Prism will only plot the horizontal error bars if you turn on plotting of the Y error bars too. Even if you have entered to replicates or error values for Y values, you need to tell Prism to plot the Y error bars in order for it to plot the X error bars. To do this, choose "Mean and error" in the appearance drop down in Format Graph, and "Mean and SEM" in the Plot dropdown.

Rotate Column or Grouped graphs so the Y axis is horizontal

A choice on the third tab of Format Graph, lets you flip any Column or Grouped graph 349 so the Y axis is horizontal. If you plot symbols or bars with error bars, those error bars will now be horizontal, but that horizontal axis is now the Y axis.

Depth charts

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When you place an XY graph on a layout, you can choose to have it rotated 90 degrees to create a depth chart 554. Error bars that are vertical on the graph will now be horizontal on the layout.

14.3.2 Graphing replicates and error values

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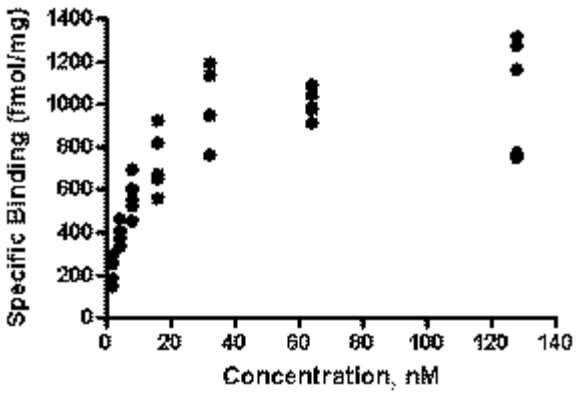
14.3.2.1 Graphing each replicate

The advantage of showing every replicate instead of error bars

When making a XY graph, Column graph or Grouped graph, you don’t have to plot error bars. Instead you can graph each data point (replicate). This is often the best way to display variation, as it shows your data exactly. Don't plot mean or median with error bars too quickly. Stop to think about whether a graph of the actual data would be more informative.With modest amounts of data, it is almost always better to show the data.



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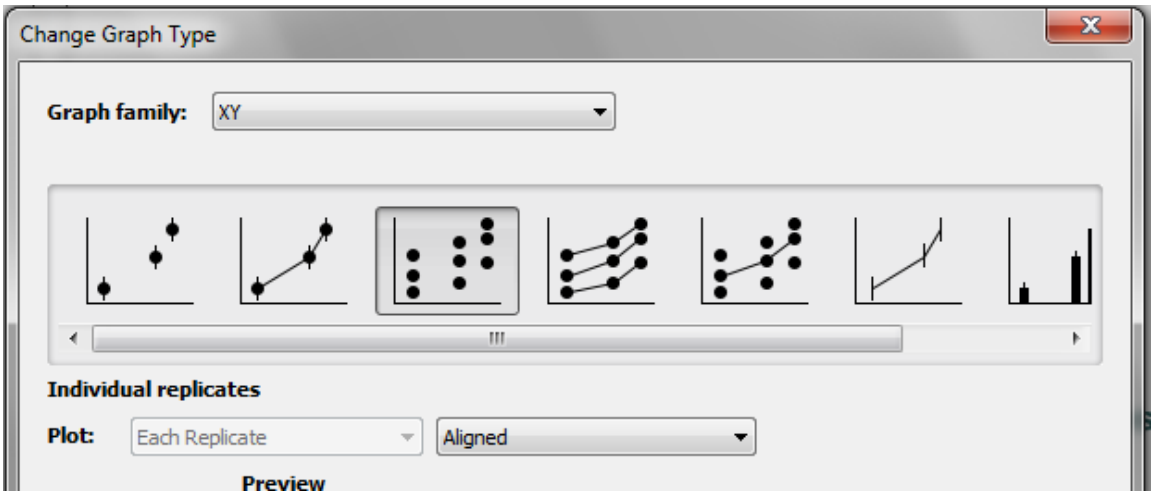
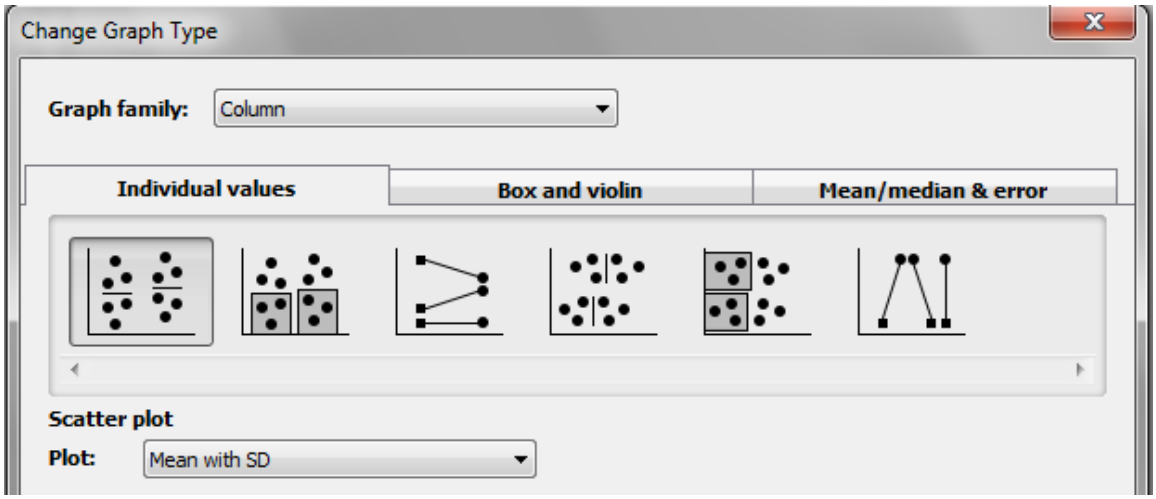
XY graphs

Choose Individual Replicates when you pick the error format for your graph.



Column graphs

Choose to make a scatter plot.



Grouped graphs

Choose the Plot individual values tab. Then choose any of the graph types.

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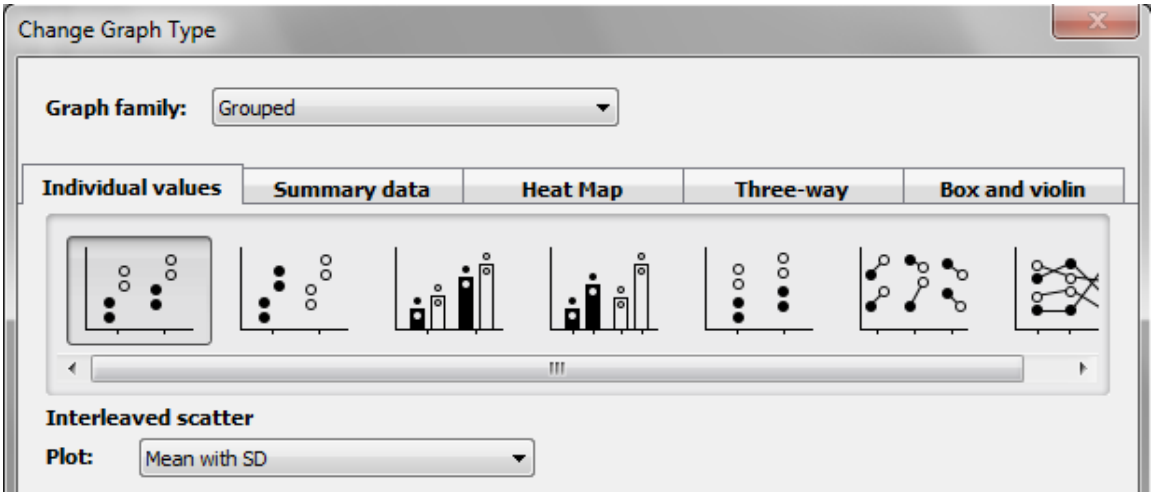

14.3.2.2 Box and whiskers graphs

Before creating a box-whiskers plot, consider a violin plot 384 instead.

Creating a box and whiskers plot

Prism lets you create box-and-whisker plots from stacks of values entered into a Column table, or side-by-side replicates entered into an XY or Grouped table.

The box

The box always extends from the 25th to 75th percentiles. These limits are sometimes called the *hinges* of the plot. Surprisingly, there are multiple ways to compute these percentile values. Prism uses a standard method, but a different method than Excel uses.

The line in the middle of the box is plotted at the median. You can not choose a different value, but Prism also lets you put a "+" at the mean.

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The location of the whiskers

Prism offers six ways to create whiskers in box-and-whiskers plots:

- Min to max. The whiskers go down to the smallest value and up to the largest.
- Tukey. See details below.
- 10 to 90 percentiles. The whiskers are drawn down to the 10th percentile and up to the 90th. Points below and above the whiskers are drawn as individual points.
- 5 and 95 percentiles
- 2.5 and 97.5 percentiles
- 1 and 99 percentiles
- Min to max, show all points. This method plots whiskers down to the minimum and up to the maximum value, but also plots each individual value as a point superimposed on the graph.

Other options

- Choose the border color and thickness, and fill the box with color.
- Plot the mean as a "+".
- Choose a fill pattern for the box, and choose the design (pattern) and color.

More about box and whisker plots

How the Tukey method plots whiskers and outliers

1. Calculate the inter-quartile distance (the difference between the 25th and 75th percentiles). Call this the IQR.
2. Add the 75th percentile plus 1.5 times IQR. If this value is greater than (or equal to) the largest value in the data set, draw the upper whisker to the largest value. Otherwise stop the upper whisker at the the largest value less than the sum of the 75th percentile plus 1.5IQR, and plot any values that are greater than this as individual points.

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3. Calculate the 25th percentile minus 1.5IQR. If this value is less than the smallest value in the data set, draw the lower whisker to the smallest value. Otherwise stop the lower whisker at the lowest value greater than the 25th percentile minues 1.5IQR, and plot any values that are greater than this as individual points.

Notes on Tukey boxplots

- Why 1.5IQR? There is no statistical rationale; it is simply how Tukey decided to do it, and he invented the idea of box-and-whisker plots.
- When the Tukey method is used to create the whiskers, the ends of the whiskers are sometimes called the inner fences.
- The values that are plotted individually are sometimes called outliers, but "outlier" is defined differently by Grubbs test or some other outlier test. The chance of finding one or more "outlier" by Tukey's rule in data sampled from a Gaussian distribution depends on sample size.
- If you only enter three values per group (n=3), Prism will plot the median and range. It will not plot the percentiles and will ignore your choice for how to plot the whiskers.
- With Tukey's method, the whiskers always end at a value matching one of the values in the sample. So the two whiskers are often not the same length.
- The terms boxplot and box-and-whiskers plot are often used interchangeably, although originally the boxplot was used to describe a plot with Tukey whiskers (fences) and the box-and-whisker plot was used to describe a plot where the whiskers extend down to the minimum value and up to the maximum value.

Five number summary

The term *five-number summary* is used to describe a list of five values: the minimum, the 25th percentile, the median, the 75th percentile, and the maximum. These are the same values plotted in a box-and-whiskers plot when the whiskers extend to the minimum and maximum.

The term *outlier*

The term *outlier* has many definitions. The individual points that are plotted beyond the whiskers of a box-and-whiskers plot are sometimes called outliers, but

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this definition does not match the definition used by the Grubbs' or other outlier tests.

How to create a box-and-whiskers graph by entering the minimum, maximum, median and 25th and 75th percentiles rather than entering the raw data

Usually, Prism creates a box-and-whiskers graph from raw data. You enter a stack of values, and Prism computes the range and percentiles to make the box-and-whiskers graph.

You need to be just a tiny bit sneaky if you want to enter the minimum, 25th percentile, median, 75th percentile, and maximum values directly. Prism won't know that you entered those values, but will make the graph as if you entered raw data. If you just enter those five values, Prism will correctly compute the minimum, maximum, and median, but the 25th and 75th percentile values Prism computes will be incorrect.

Here is a trick: Enter the median value three times, rather than once, and also enter the minimum, maximum, and 25th and 7th percentile values. For each group, enter seven values on separate rows of one column (the order doesn't matter.)

- Minimum
- 25th percentile
- Median
- Median
- Median
- 75th percentile
- Maximum

You can't "tell" Prism that these values are not the raw data, so it "thinks" they are raw data and so computes the minimum, maximum, median and quartiles from those seven values, and plots those computed values, which exactly match the values you entered. If you use this workaround to create a box and whisker plot from summary data, the

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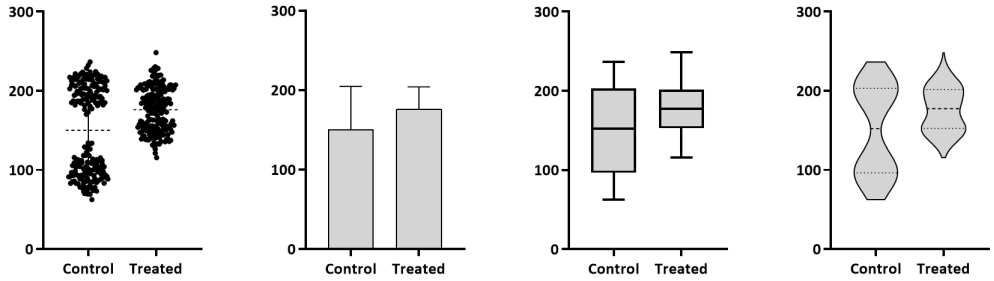
choice to plot the mean as a + won't work. It will compute the mean from the values you entered, and that mean is unlikely to equal the actual mean of the data.

14.3.2.3 Violin plots

What is a violin plot?

When you enter replicate values in side-by-side replicates in an XY or Grouped table, or stacked in a Column table, Prism can graph the data as a box-and-whisker plot or a violin plot. Violin plots show the frequency distribution of the data. The example below shows the actual data on the left, with too many points to really see them all, and a violin plot on the right. It gives the sense of the distribution, something neither bar graphs nor box-and-whisker plots do well for this example.



How smooth?

You decide (in the Format Graph dialog) how smooth you want the distribution to be. You have three choices shown below: Light (left), medium (middle), heavy (right). Light smoothing shows more details of the distribution; heavy smoothing gives a better idea of the overall distribution.

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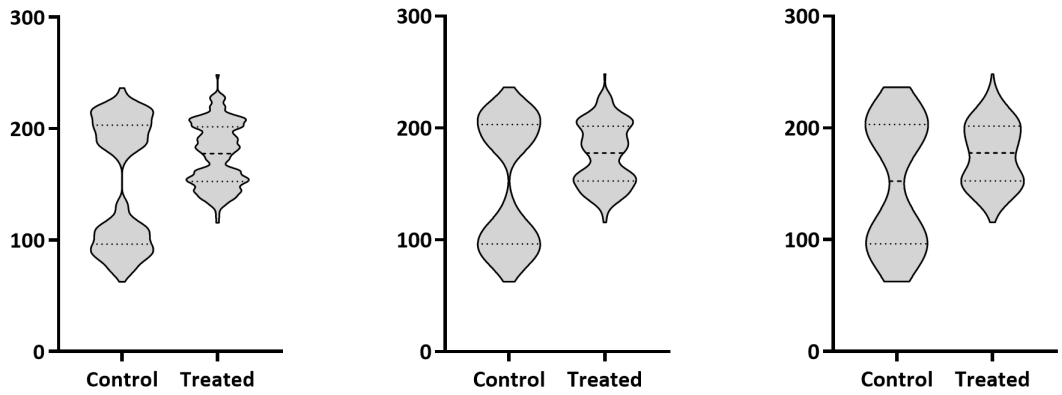
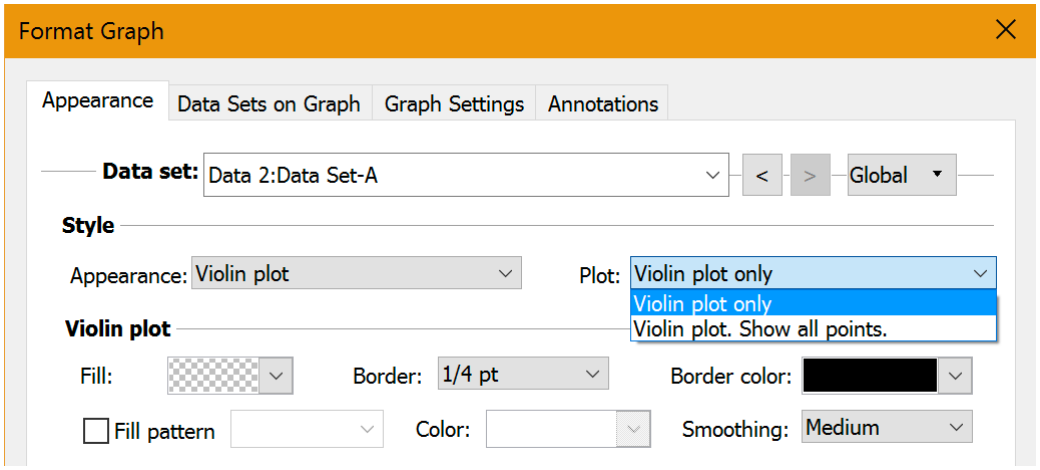


Showing individual points and violin plot

Prism lets you superimpose individual data points on the violin plot. This is not really helpful for displaying data. Why show both the data and a crude distribution? But it is very useful when exploring which level of smoothing to use. It is hard to assess the degree of smoothness of the violin plot if you can't see the data at the same time.

If you use small points the same color as the violin plot, the highest and lowest points won't be visible as they will be superimposed on the top and bottom caps of the violin plot itself. If you want to see these points, make them larger or a different color.



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Notes

- Violin plots are new in Prism 8. They are a great way to show data. Use them!
- Surprisingly, the method (kernal density) that creates the frequency distribution curves usually results in a distribution that extends above the largest value and extends below the smallest value. As violin plots are meant to show the empirical distribution of the data, Prism (like most programs) does not extend the distribution above the highest data value or below the smallest. That is why violin plots usually seem cut-off (flat) at the top and bottom.
- In addition to showing the distribution, Prism plots lines at the median and quartiles. Separately specify the pattern (dotted, dashed..), color and thickness for the median line and for the two quartile lines.
- You can choose to fill within the violin plot, as the example shows.
- Violin plots show the median and quartiles, as box-and-whisker plots do. But violin plots do a much better job of showing the distribution of the values. Consider always using violin plots instead of box-and-whisker plots.

14.3.2.4 Graphing error bars computed from replicates

Reality check

It is very common to publish data with error bars, and Prism does this well. But first think if this is really the best way to display your data. Consider plotting each replicate 378 or plotting a violin plot 384 instead. These kind of graphs show much more detail.

What Prism can do

When you entered replicate data, Prism can plot on XY and Grouped graphs:

- Mean only

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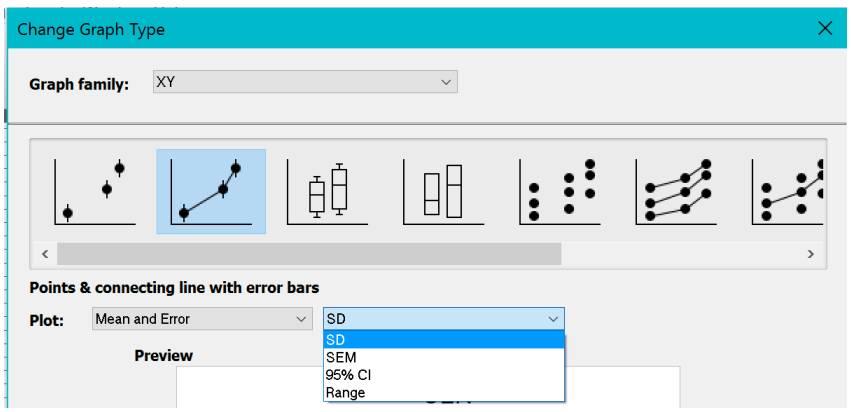
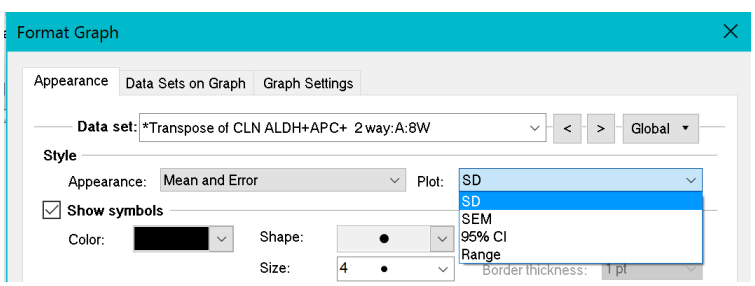
- Mean with error bars computed as SD, SEM, 95% CI, or range.
- Geometric mean only
- Geometric mean with error bars computed as 95% CI, or geometric SD factor
- Median only
- Median with error bars computed as 95% CI, interquartile range, or range

Choose on the New Graph (or Change Graph Type) dialog:



You can also change on the Format Graph dialog. This will change one data set at a time, unless you choose to make Global changes using the control in the upper right of the dialog.



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14.3.2.5 Graphing error bars computed from entered error values

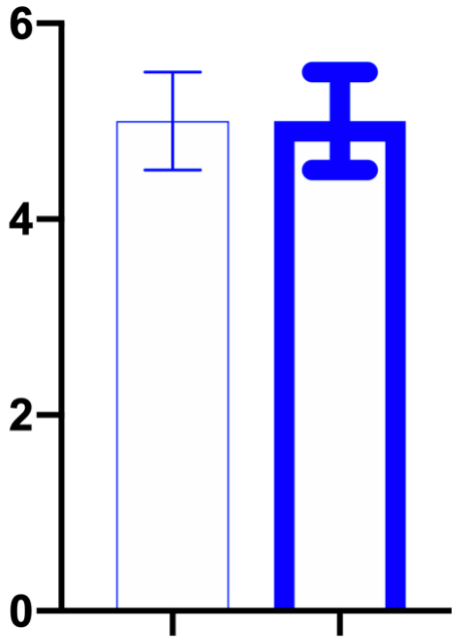
If you entered error values into the data table (for example SD or SEM), Prism will plot the error value you entered. If you entered %CV, Prism will plot the SD.

If you created a table with a subcolumn for sample size n, then Prism gives you more flexibility. It can plot SD, SEM or %CI from data entered as either Mean, SD & n, as Mean, SEM & n, or Mean, %CV & n.

14.3.2.6 Why do error bars on bar graphs sometimes appear asymmetrical?

One reason for asymmetrical error bars is because they actually are asymmetrical. If you enter separate up and down error values, they may not be the same. If you plot median with quartiles, the error bars are likely to be asymmetrical.

But if you plot mean and SD (or SEM), how can the error bars appear asymmetrical. The figure below demonstrates.



The error bars on the bar on the right seem asymmetrical. But look closer. The outer border denotes the mean, and the entire bar's thickness is inside the bar (for Prism 7 and later). Thus, the error bar is symmetrical around the outer edge of the bar. But because part of the down-pointing error bar is covered by the bar's thick inner border, the

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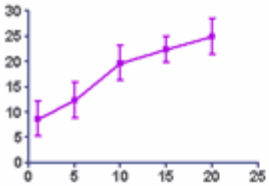
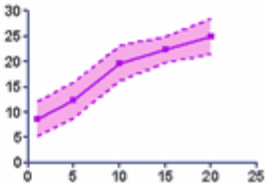
error bars appear asymmetrical. The workaround, of course, is to make the bar borders thinner.

14.3.2.7 Graphing error envelopes

In some cases you may prefer to plot the error values as error envelopes, as shown on the right below, rather than error bars (left).





To plot error envelopes on an XY graph, on the first tab of Format Graph make two settings:

1. Drop the error bar style drop down and choose one of the two horizontal line choices (solid or dotted).

2. Check the option to show area fill, choose a color, and choose to put the fill within the error bands.

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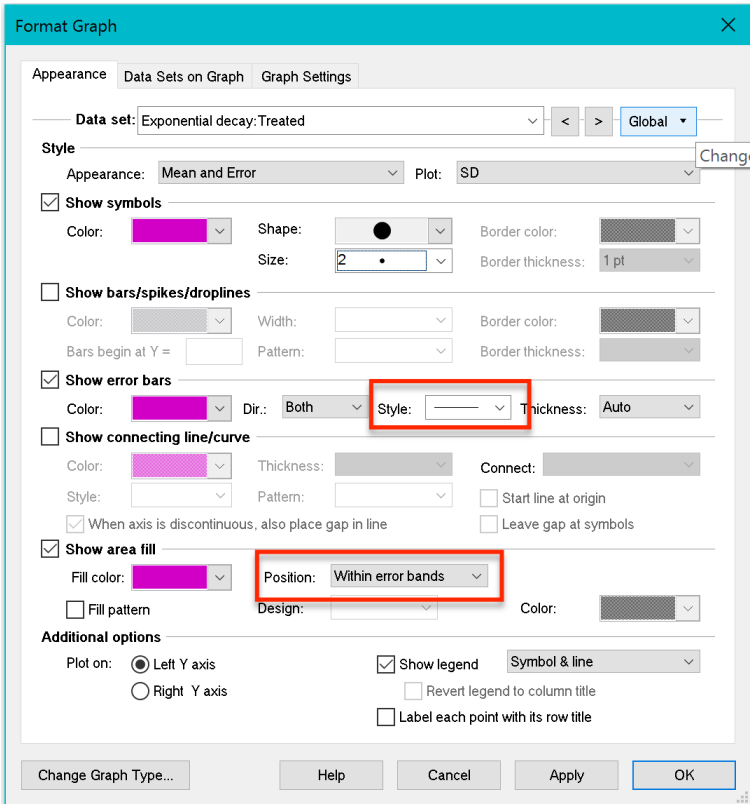

14.3.2.8 Confidence and prediction bands from regression

When you fit a line with linear regression, or a curve with nonlinear regression, you can choose to plot confidence or prediction bands. Confidence bands tell you how precisely you have determined the line or curve. Prediction bands tell you about the scatter of the data.

Learn more about choosing and graphing prediction and confidence bands from linear regression and nonlinear regression.

Prediction and scatter bands are computed using complicated calculations that are part of the regression procedures. You don't enter these values directly. All you do is check an option when choosing analysis options.

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14.4 The Format Graph Dialog

Prism lets you customize every feature of a graph. Change the shape, color, and size of graph symbols; change the fill pattern and color of

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graph columns; change the order that data sets are plotted.

14.4.1 Overview of Format Graph

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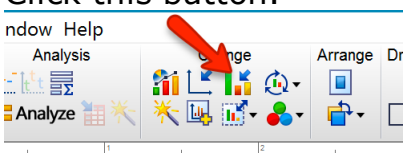
14.4.1.1 How to bring up the Format Graph dialog

Two ways:

- Double-click on the main part of the graph (not an axis).
- Click this button.



14.4.1.2 Different Format Graph dialogs for different kinds of graphs

Each kind of graph has a different Format Graph dialog.

XY graphs 398

Column graphs 419

Grouped and Contingency graphs 438

Heat maps 471

Survival graphs 479

Parts of whole graphs 486

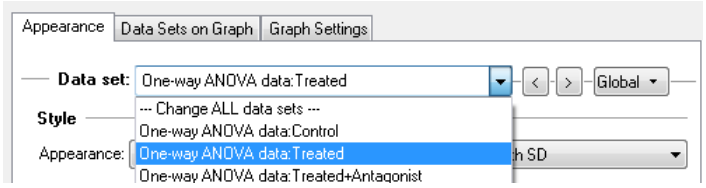
Nested graph 491

14.4.1.3 Changing one, some or all data sets

Parts of whole and heat maps are distinct, but for XY, Survival, Column, Grouped and Contingency table graphs, the first tab of the Format Graph dialog controls the appearance of symbols, bars, lines, etc.

Change the appearance of one, several, or all data sets.

- **One data set.** Choose a data set from the drop down on the top of the dialog, then change the settings for that data set.



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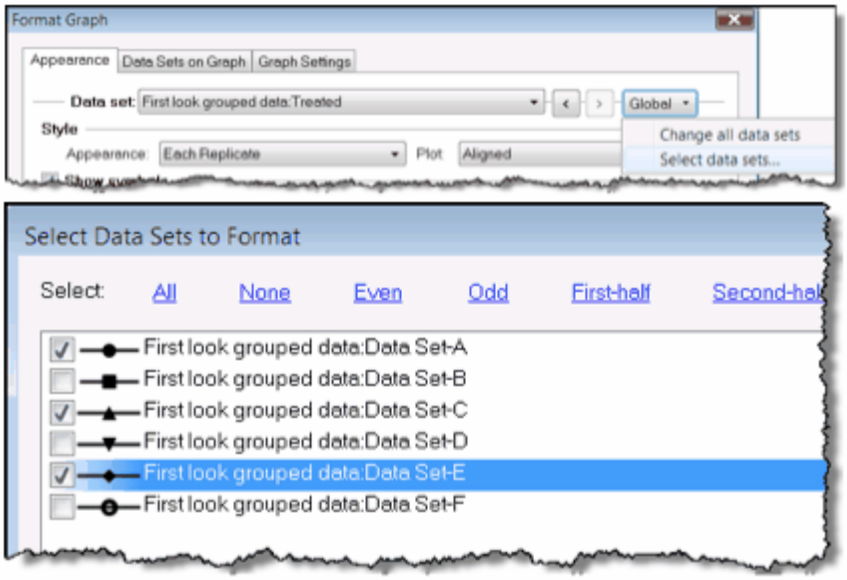
- **All data sets.** Drop the Global menu at the top right of the dialog, choose to change all data sets, and then make the changes. Any changes you make after choosing the change all data sets will apply to all the data sets. Changes you made before making that choice only apply to the data set selected then. Shortcut: Hold the Control key down while you make changes. Any changes made while holding Control down will apply to all data sets on the graph. When you are in global mode (change all data sets), the cursor changes to include a globe:

- **Several data sets**. Drop the Global menu at the top right of the dialog. Choose some data sets, and then change the settings for those data sets. For example, you could select data sets A, C, E, and G and change all of those data sets to use a dotted line. Then choose B, D, F and H, and make those lines solid. Any changes you make after choosing a set of data sets to change will apply to those data sets.



14.4.1.4 Style

The Style selections at the top of the Format Graph dialog is where you make the most important choice about your graph. Graph points or bars? Error bars? If so, showing what error value (SD, SEM, Range, ...)?

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The choices available here depend on what kind of graph you have chosen (XY, Column, Grouped, etc.) and how you entered your data.

14.4.1.5 Symbol shape and border

You can plot symbols on Column, Grouped, Contingency, and XY graphs.

Notes:

- You will only have choices of border color and thickness when you choose an open symbol (as shown above).
- The standard set of symbols will probably have what you want:

- If you click "More", you can choose any character from any font to use instead of a symbol.

14.4.1.6 Bar borders and fills

You can plot bars on Column, Grouped, Contingency, and XY graphs.

Formatting bars works a bit different than it did in prior Prism versions. By default, the bars are solidly filled with a color you choose, and have a border whose thickness and color you choose.

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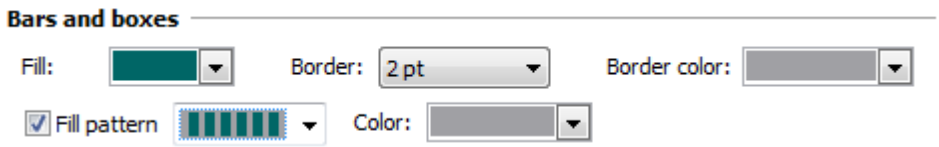
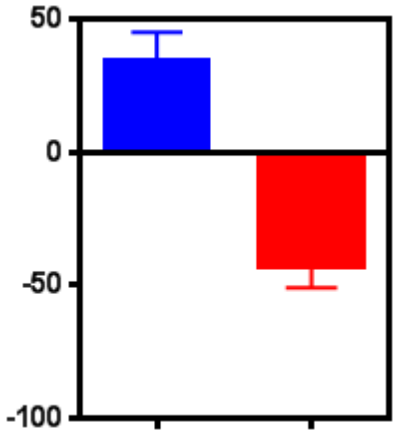
If you want a fill pattern, check the option box, then choose the design (the fill pattern) and color.



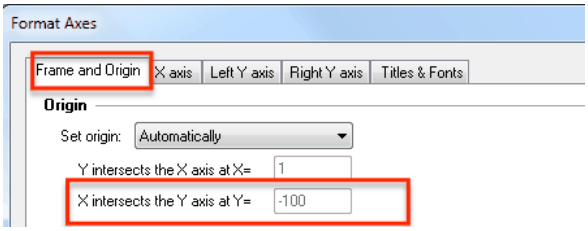
14.4.1.7 Distinguishing the X axis from the bar baseline

If you make a Column or Grouped bar graph with some bars having positive values and others having negative values, Prism will by default make a graph like this:



Distinguish the X axis from the bar baseline.

- The X axis in the graph above is at the bottom of the graph. Set the location of the X axis (and move it to Y=0) if you want in the first tab of the Format Axis dialog. Bring up this dialog by double clicking on any axis.



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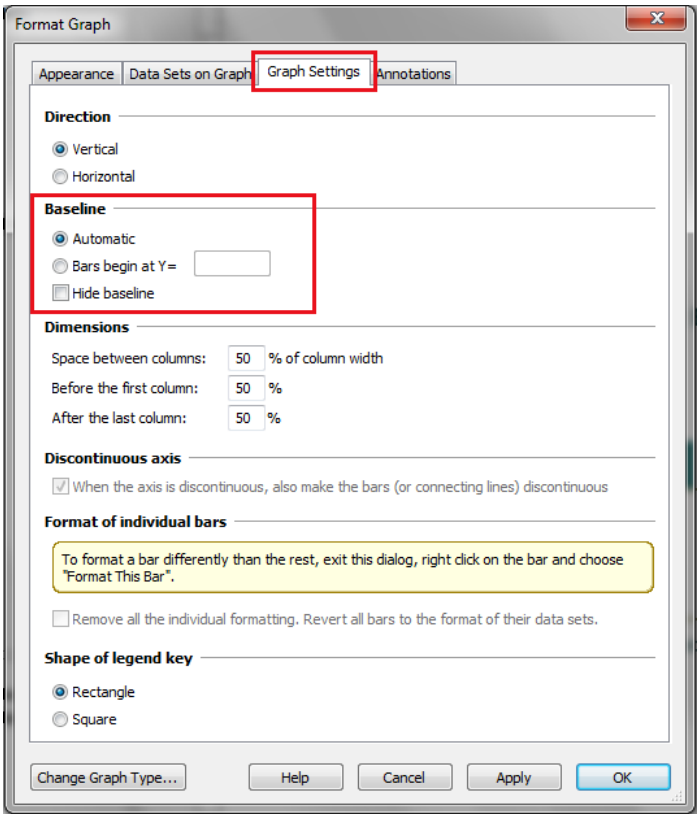
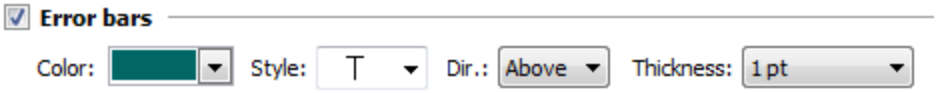
- The bar baseline is set in the third tab of the Format Graph dialog. In the graph above, the setting is at its default value of "automatic" which means Prism draws the baseline at Y=0. Bring up this dialog by double clicking on the main part of the graph.



The default graph, as above, is usually what you'll want. But if you want something different, knowing how the X axis and the bar baselines are set will let you make the kind of graph you want.

14.4.1.8 Graphing error bars

You'll be able to choose error bars for XY, Column and Grouped graphs. Choose the color of the error bars, the direction (up, down or both), the style (capped or not) and thickness.



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Notes on error bars:

- Prism can plot several kinds of error bars: SD, SEM, interquartile range, etc. Choose this at the top of the Format Graph dialog in the style section. If you entered error values directly, then you can plot those values only.
- In XY graphs, you can plot the error bars as error envelopes or bands 389 and fill the area between the two bands.
- Survival graphs 480 deal with error bars differently.
- Learn more about error bars 372.

14.4.2 XY graphs

Format graph: XY

Prism lets you customize every feature of a graph. Change the shape, color, and size of graph symbols; change the fill pattern and color of graph columns; change the order that data sets are plotted.

Double-click on any symbol (or the background of the graph) to bring up the Format Graph dialog.

See also

Appearance of XY graphs 399

Front-to-back order of data sets 405

Use row titles to label data points 407

Nudging XY data sets 408

Additional XY settings 411

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14.4.2.1 Format Graph -- XY

Format Graph dialog - XY graphs

Use this dialog to change the look of all the symbols in a data set. If you want to change the look of a single data point 351, use the right-click menu. You can also change all the symbols in selected data sets 351.

Double-click on any graph symbol or bar to open the Format Graph dialog.

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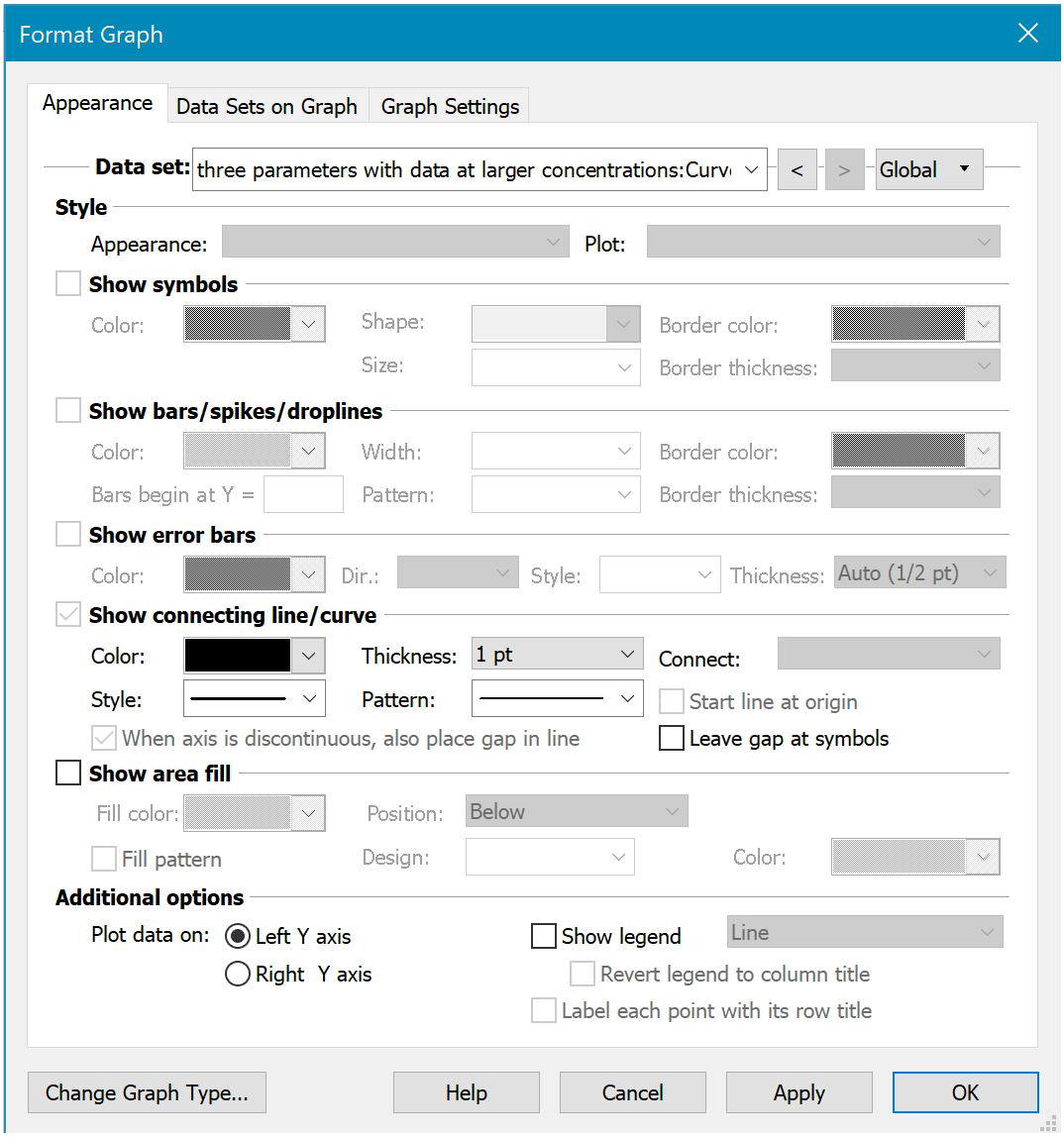

To change the settings for one data set:

Select a data set from the list, and choose the symbols, lines, and error bars for that data set. Then select another data set and choose settings for that data set. Click OK to redraw the graph with all the changes. Note that a fitted curve is treated as a separate data set.

To change all data sets on the graph for example to make all symbols larger:

Click the Global button at the top right of the Format Axis dialog. Then choose to change all data sets, or a subset of data sets. Changes you make after that will then apply to all selected data sets.

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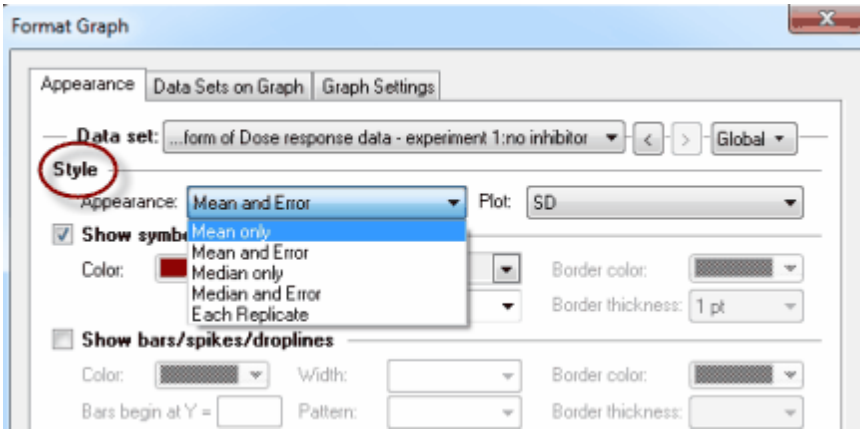
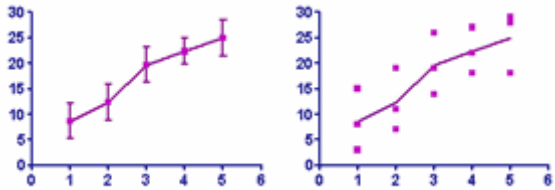
There is a shortcut for changing all -- Hold down the control key. (Note the 'globe' cursor since you are making global changes.)

Style

Choose how to plot error bars. Select SD, SEM, 95% CI, or range. If you created a data table with no Y subcolumns, you won't have any choices here. But, if you entered data into subcolumns, the choices here determine how the replicates or error bars will appear. The Appearance drop-down on the left determines the basic look, with further choices in the Plot drop-down to the right (the choices will depend on what you select in Appearance).





Since it rarely makes sense to choose different error bar (or replicate) choices for different data sets, you will probably want to click Global and then All before changing error bar format.

If you have four or more subcolumns for replicates, Prism will also give you the opportunity (at the bottom of the appearance drop down menu) to plot box-and-whiskers at each X value.

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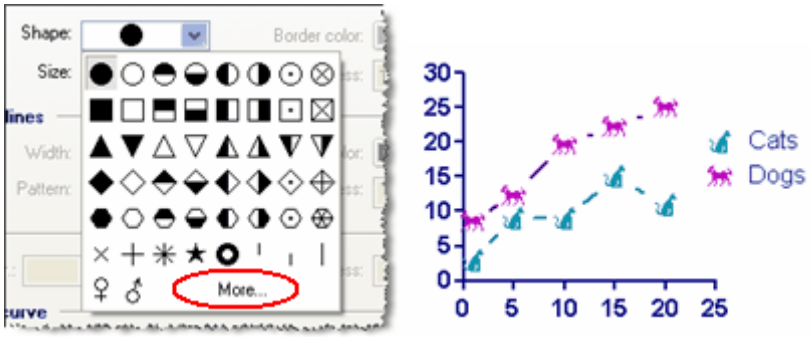
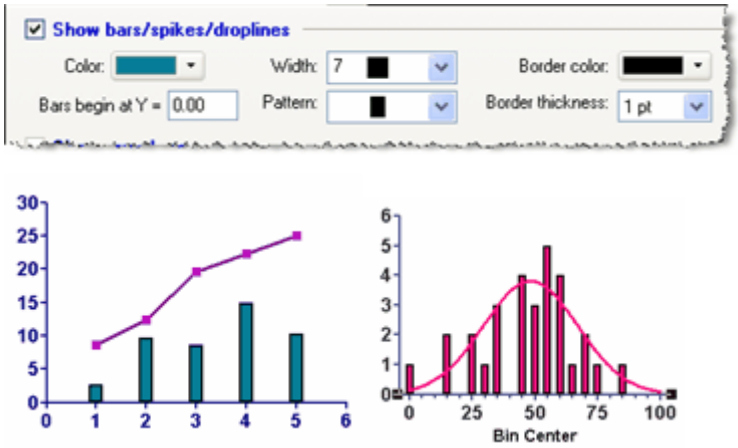
Show symbols

Choose symbol type, size, and color. If you pick an open symbol, also select a border thickness. Check the Clear option if you want point-to-point lines and overlapping points to show through the open symbol. Use the Shape drop-down menu to select one of Prism's symbols. Use the More option on this drop-down to use any character from any font on your computer as a symbol.



Show bars/spikes/drop lines

Use this setting if you want to drop vertical bars from your data points. The bar will start at the X-axis or whatever Y value you choose and go up (or down) to the Y position of the point. This is useful when you want to create a bar graph where each bar's position is determined by its X value. It is also useful when you want to combine points and bars on one graph as shown below. If you pick the narrowest width for the bars, the bars will actually be spikes suitable for graphing mass spectra.



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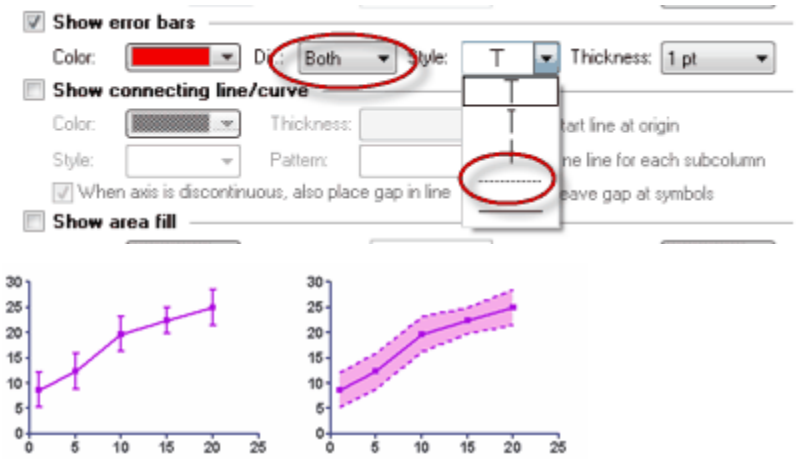
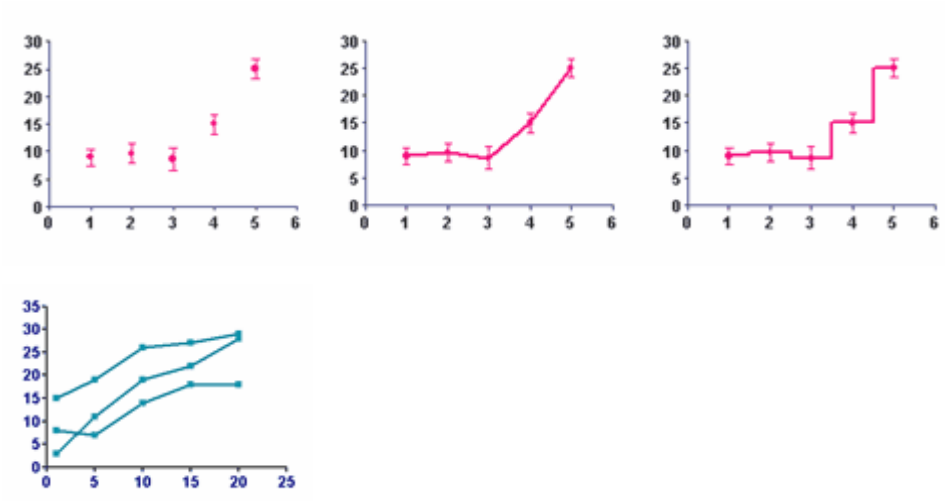
Show error bars

Choose the format and color of error bars. Choose dotted or solid lines to show an error envelope as in the graph on the right below. Use the Show Area Fill button to add fill between the limits of the error envelope.



Connecting line/curve

Choose the line's color, style (straight vs. staircase), thickness, and pattern (solid, dotted, dashed, etc.). This section includes choices to have your connecting start either at the first data point or the graph origin, whether to leave gaps in the connecting line next to the symbols, and whether to plot lines connecting each replicate for repeated measures in corresponding data sets as in the graph on the bottom row below.



If you choose arrows as connecting lines, it looks best to not also show symbols.

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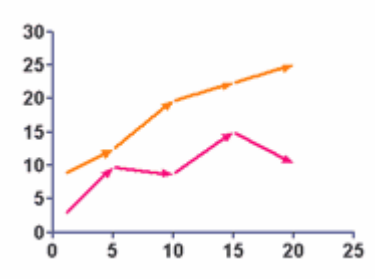
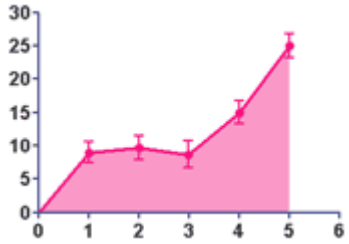


Don't confuse the connecting line – which always goes from point to point – with a best-fit curve or line created by regression. If you have fit a curve through the data, Prism sees the curve as a separate data set. Select the data set for the values, and choose symbols but no connecting line. Then choose the data set for the curve, and choose a connecting line (curve) with no symbols.

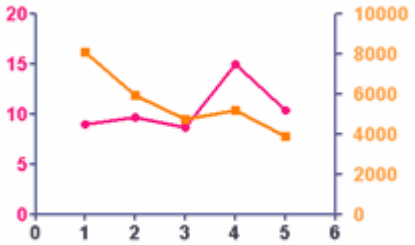
Area fill

Fill below (or above) the point-to-point line that connects your points with a fill. Specify fill color and pattern, and background color. You may need to adjust the front-to-back order 405 of the data sets to get the effect you want.



Plot on which Y axis

Specify which axis to use for each data set. If you choose to plot on the right Y-axis, Prism will create that axis if it doesn't already exist.



Legend

Select Show legend to create a legend for this data set. Select Label each point with its row title to link the legend to the column title entered on the data table. Uncheck this box if you don't want the legend to change when you edit the column title. You can also edit the labels in the legend. Double-click on the legend text and type whatever you like. Use the checkbox Revert Legend to Column Titles in the Legend to

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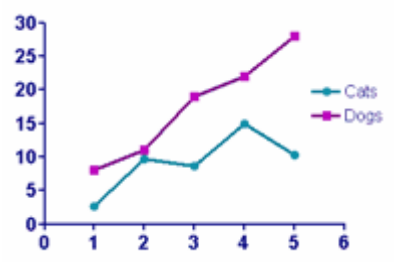
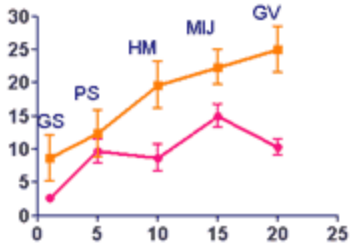
change the labels back to match the column titles. (This checkbox is only available if you have edited a legend.)



Label each point with its row title

Check this box to include row titles 247 on graph near each data point. You can move each label by selecting it and dragging. Even if you move a label, however, it remembers its position relative to the data point -- so when you change your data, or the size and shape of your graph, the labels will adjust accordingly. Click on any label on the graph and use the Text section of the Prism toolbar to change the size, font, and color of all the labels.

Table format: XY	X	Group A	
	Days	Cats	
	X	A:Y1	A:Y2
1 GS	1	3	2
2 PS	5	7	133
3 HM	10	9	12
4 MIJ	15	12	15
5 GV	20	12	11



14.4.2.2 Front-to-back order of data sets

When data points overlap (or are superimposed) on an XY graph, the plotting order determines which will show on top.

The two graphs in this example are identical except that the plotting order was reversed. Note the green symbols are behind the clear ones in the graph on the left, and in front on the graph on the right.

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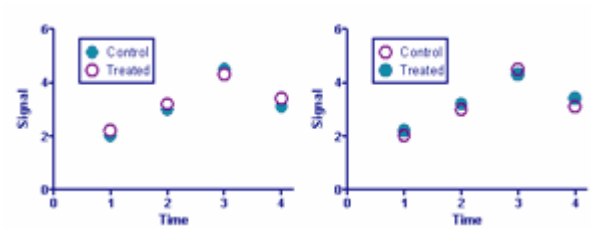
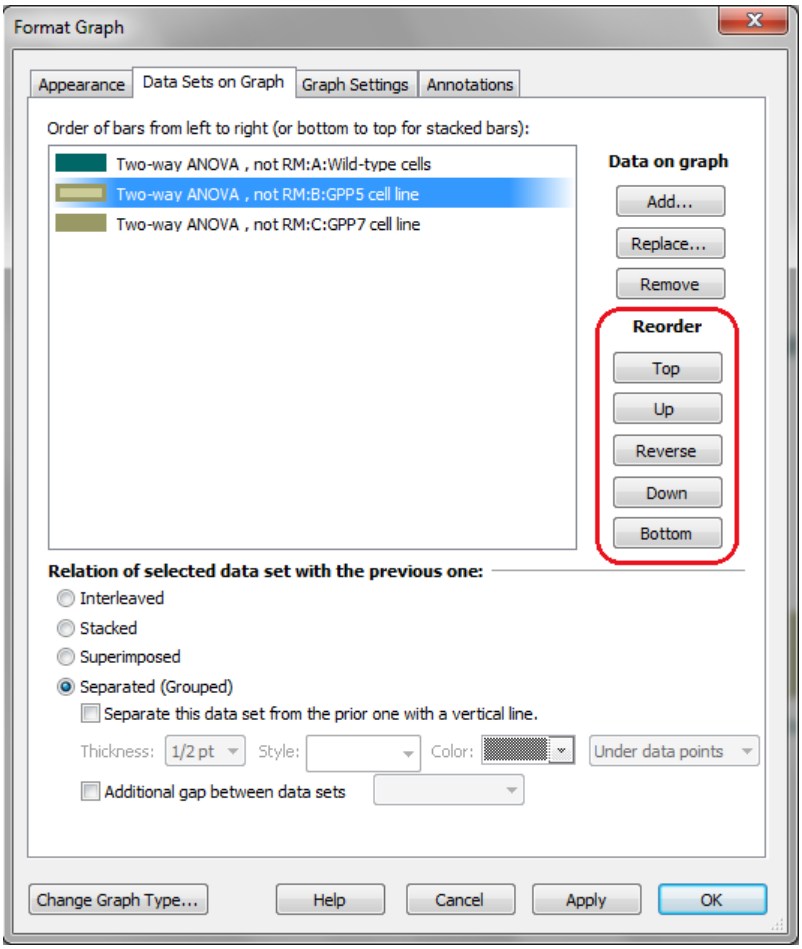


To change the front-to-back order of the data sets on a graph:

Click the Rotate/Flip button in the Change section of the Prism toolbar to reverse the front-to-back order of data sets on a graph.

To fine tune the front-to-back order, go to the Data Sets on Graph tab of the Format Graph dialog.



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Changing the order of the data sets on this dialog changes the font-to-back order of the data sets on the graph. It does not change the order of the legends 356.

Front to back order within a data set

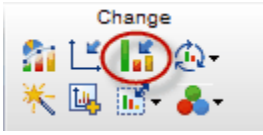
Within a data set, the front-to-back order of plotting is determined by the order of rows in the data table. The first row is furthest back and the data entered in the last (bottom) row is plotting in front. If you need to control which point is on top, change the order of the rows.

See also:

Nudging data sets on a graph. 408

14.4.2.3 Use row titles to label data points

Enter row titles 247 in a special column on the XY data table.



Click on the Format graph button on the Prism toolbar or double-click on any data point to open the Format Graph dialog. Check the "Label each point with its row title" box to include row titles 247 on graph near each data point.

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You can move each label by selecting it and dragging. Even if you move a label, however, Prism remembers its position relative to the data point -- so when you change your data, or the size and shape of your graph, the labels will adjust accordingly.

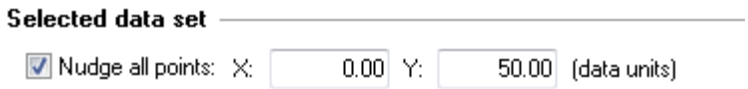
Click on any label on the graph and use the Text section of the Prism toolbar to change the size, font, and color of all the labels. You cannot adjust the font individually. All the row labels always share the same font, size and color.

14.4.2.4 Nudging XY data sets

Nudge overlapping data sets to make a graph easier to understand.

Double-click on any data point to open the Format Graph dialog. Use the bottom of the Data sets on Graph tab to nudge a data set.

Nudging adds a specified value to each X and Y coordinate before graphing. Use this feature cautiously, as it means that the position of the symbol on the graph will not match the actual X and Y values of the data point.



The values you enter are the actual increments of X and Y. Each data set is incremented as much as you specify. The nudging is not cumulative

Nudging can be helpful to differentiate datasets that otherwise overlap a lot. For example, the data in the following graph overlap so much it is impossible to tell which tracing is which.

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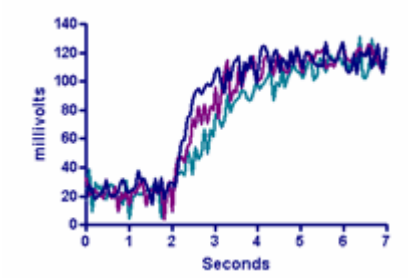
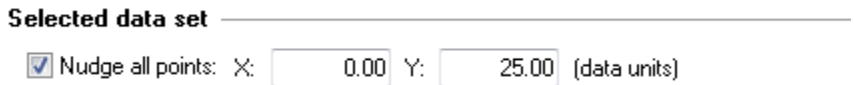
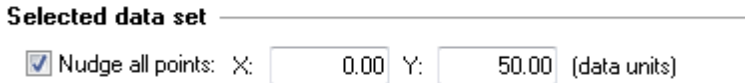


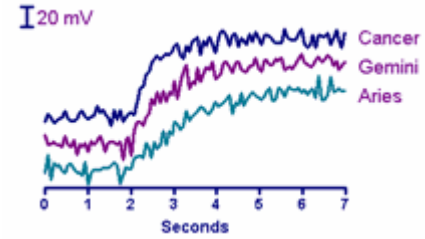
The graph below is an alternative way to plot the same data. The second data set is nudged by 25 units in the Y direction (and not at all in the X direction).



The third data set is nudged 50 units in the Y direction (with zero in the X direction).



Now you can see the individual tracings.



All three tracings still have about the same baseline Y coordinates. But nudging the data in the Y direction separated them. Because the Y values were nudged, it would be misleading to plot the data on a full Y axis as in the graph above. So instead, the Y axis is hidden (Frame and Origin 537 tab of the Format Axes dialog) and replaced with a scale bar.

Waterfall graphs

Nudging can also help you create a waterfall graph. All the data sets in the following graph cover the same range of wavelengths, and all have a baseline of zero optical density. Each data set was nudged in both X and

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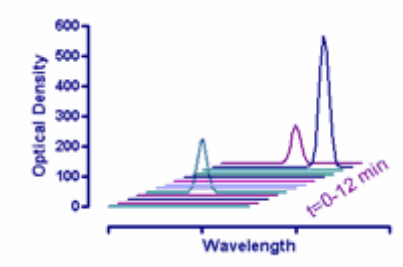
Y directions, each data set nudged a bit more than the previous data set. This creates a pseudo 3D look that is sometimes called a “waterfall”.



14.4.2.5 Skip over some points to speed graphing

Plotting XY graphs with tens or hundreds of thousands of points can be slow. If you are impatient, Prism lets you specify that a graph only show one out of every K points (you specify K), to speed up screen redrawing. Choose at the bottom of the second tab of the Format Graph dialog.

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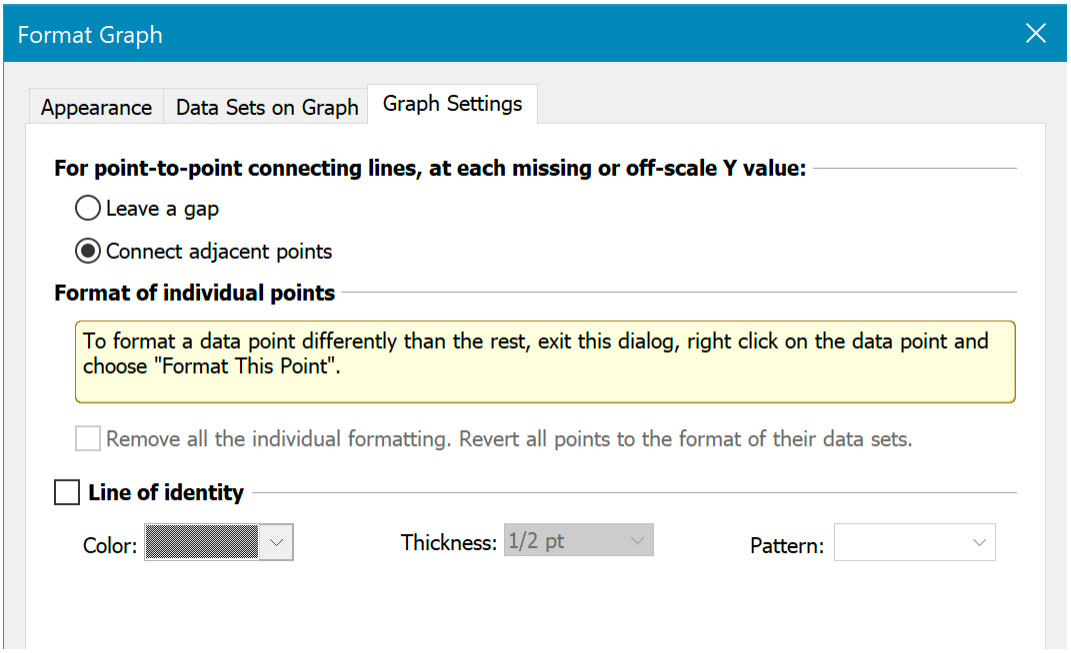
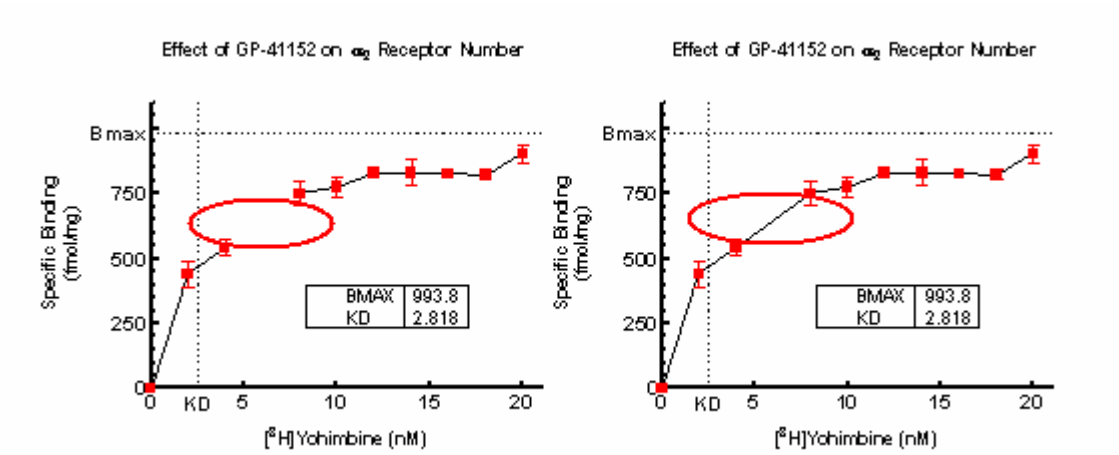
14.4.2.6 Additional XY settings

The Graph Settings tab of the Format Graph dialog



Gaps at missing points.

Leave a gap when you have missing data points, or connect the existing data points on each side.



Reset any individual formatting of points or bars

If you have changed the format of individual data points (by right clicking on them 351) , check an option here to reset everything back to the format set in the dialog.

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Line of identity

The line of identity is a line where every value of X exactly equals Y. If the X and Y ranges are the same, it is a 45 degree line. It is created automatically by some analyses, and you can check this option to add to any XY graph. If you want this line to show when the file is opened with Prism 7 or earlier, there are other ways to create it. 412

14.4.2.7 Adding a line of identity

The regression guide explains how to fit a line or curve to your data. But sometimes you just want to add a line of identity -- a line where every point has equal X and Y coordinates. Prism 8 makes this easy. Double-click on the graph to bring up Format Graph, go to the third tab, and check the option to draw a line of identity (sometimes called the line of equality).

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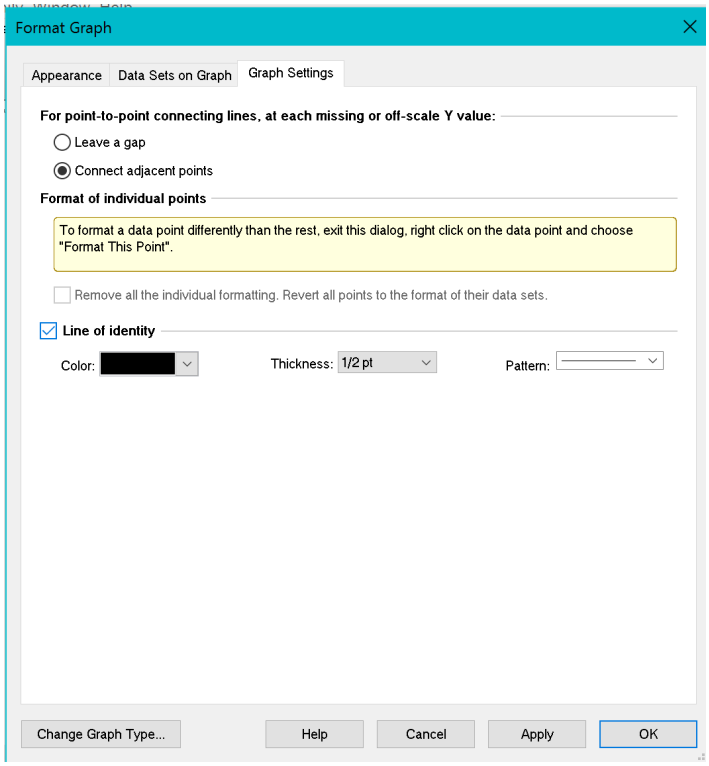

Earlier versions of Prism offered three ways to draw a line of identity. Use one of these methods if you want the line to show when you open the file with an earlier version of Prism.

- Enter a data set on your data table with only two points defining the two ends of the line you want to draw. In both cases X and Y will have the same value. You can put these points on the same data table as your data. Just put the Y values into a new Y column. Place the X values below the X for your main data set, and make sure the Y values are in the same row (many rows above that will be blank). When you look at the graph, that new data set will first show as only two data points. Double click on one to bring up the Format Graph dialog. Uncheck the option to show symbols, and check the option to show a connecting line.

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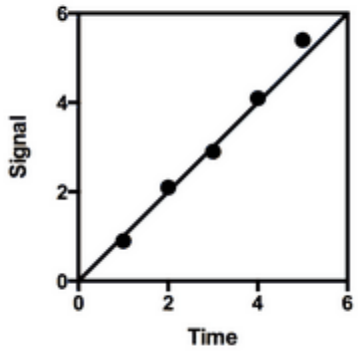
X	Group A	Group B
Time	Data	Line of identity
X	Y	Y
1	0.9	
2	2.1	
3	2.9	
4	4.1	
5	5.4	
0		0
6		6



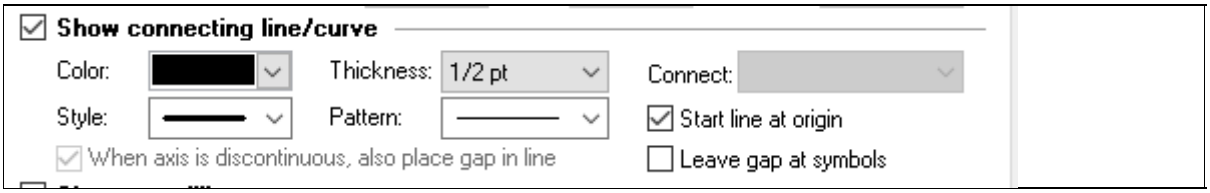
- Use the analysis to plot a function. From the graph, click Analyze, and at the bottom of the analyze dialog go to the Generate a Curve folder and choose the Plot a function analysis. Choose a straight line (from the Lines folder of equations), enter the first and last X values you want to plot the line between, and then go to the third tab of that dialog and enter values for the Y intercept (probably 0.0) and slope (probably 1.0).

- Use the line drawing tool to draw the line manually.

The first method is probably the most straightforward. The second method is great in that it can be extended to other functions besides straight lines. We don't recommend the third method, but it is a quick and easy way to produce the line for someone who doesn't want to think about math.

14.4.2.8 Point to point lines

Check on option in the Format Graph dialog to connect the XY points with point to point lines.



Notes:

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- You can choose to have the line begin at the origin by checking an option. Otherwise, the line starts with the first point.

- The lines are drawn point to point in the order the data are in the data table, which may not be in the order of the X values. But note that there is a Sort-by-X-Value command on the Edit menu you see when looking at an XY data table.

- The graphs below show four ways to draw these lines. The bottom choice is one you probably want to avoid. That graph uses open symbols with clear (transparent) fill so the point-to-point lines will be visible going through (or under) the points. You want to use white (or whatever the background color is) fill color which covers up the point-to-point lines.

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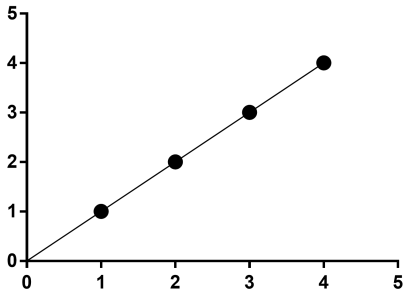
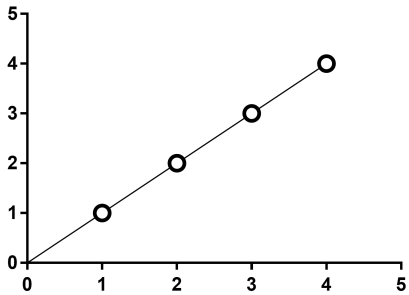
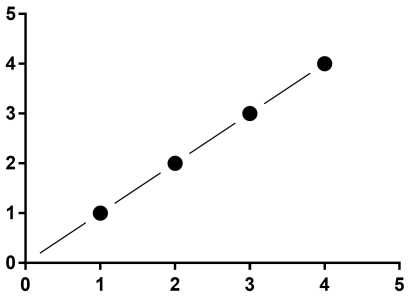


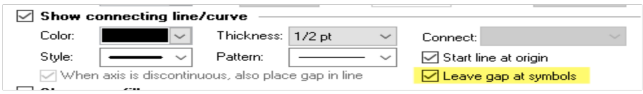
Solid symbols

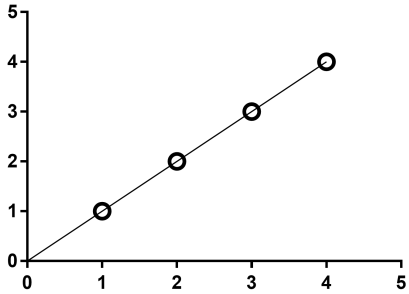


Open symbols, with white (not clear) fill.



Solid symbols with option set to skip over points





Open symbols, with clear (transparent) fill.

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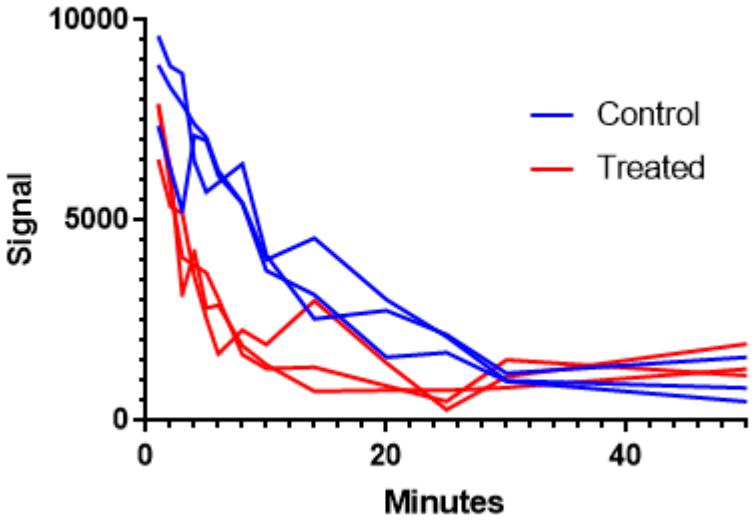
14.4.2.9 Spaghetti plot

Spaghetti graphs plot longitudinal data, showing individual tracings for each subject (or other experimental unit).



1. Enter data into an XY data table, formatted with subcolumns for replicates.

2. At the top of the Format Graph dialog, choose to plot each replicate.

3. Uncheck "Show symbols"

4. Lower on that dialog for connecting lines, choose to connect "Each replicate, Spaghetti plot".

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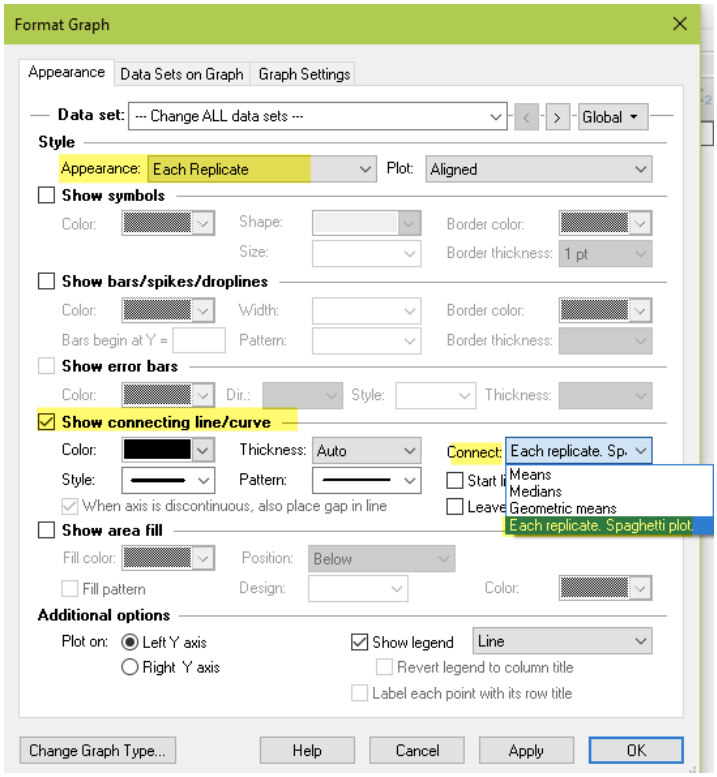

14.4.2.10 Box and whiskers plot

If you have five or more replicate values in side by side subcolumns, you can plot XY data as box-and-whisker plots. Because this is not a choice on the Change Graph Type dialog, you have to first make a different kind of XY graph (scatter, mean and error...) and then change to box and whiskers. To do that,

1. Double-click on the main part of the graph to bring up Format Graph dialog

2. Use the Global setting at the upper right to change all data sets at once.

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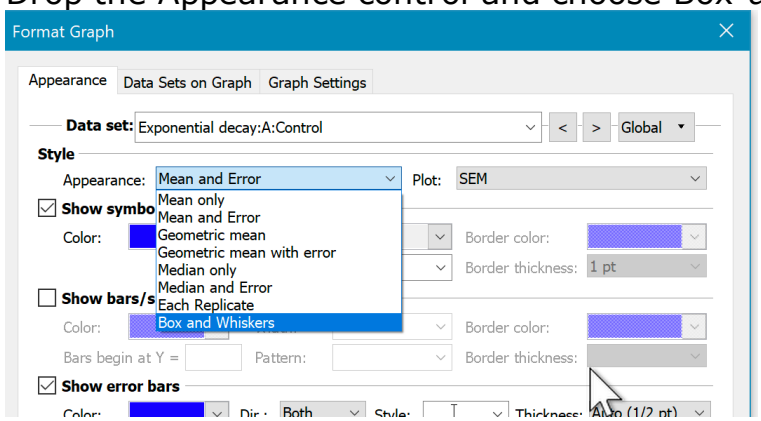
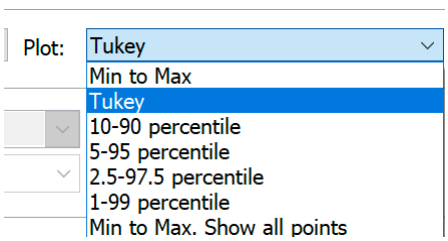
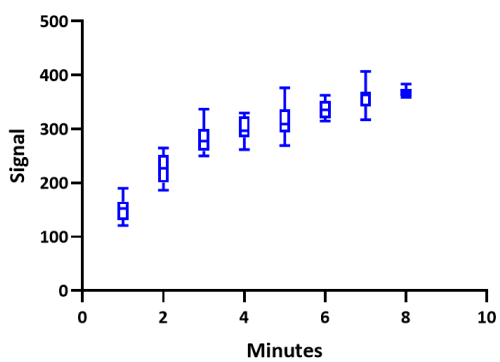
3. Drop the Appearance control and choose Box-and-whiskers.



4. Use the Plot control to fine tune.



5. Adjust the size and color of the boxes, and the width and color of the border.



14.4.3 Column graphs

Format graph: Column

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Prism lets you change every feature of a graph. Change the shape, color, and size of graph symbols; change the fill pattern and color of graph columns; change the order that data sets are plotted.

Double-click on any symbol or bar (or the background of the graph) to bring up the Format Graph dialog.

See also:

Appearance of Column graphs 420

Data set spacing on Column graphs 426

Plotting order of Column graphs 429

Additional Column graph settings 430

Graphing each replicate 378

Violin plots 384

14.4.3.1 Format Graph --Column

Format Graph dialog - Column graphs

Use this dialog to change the look of all the columns in a data set. If you want to change the look of a single column 351, use the right-click menu. You can also change all the symbols in selected data sets 351.

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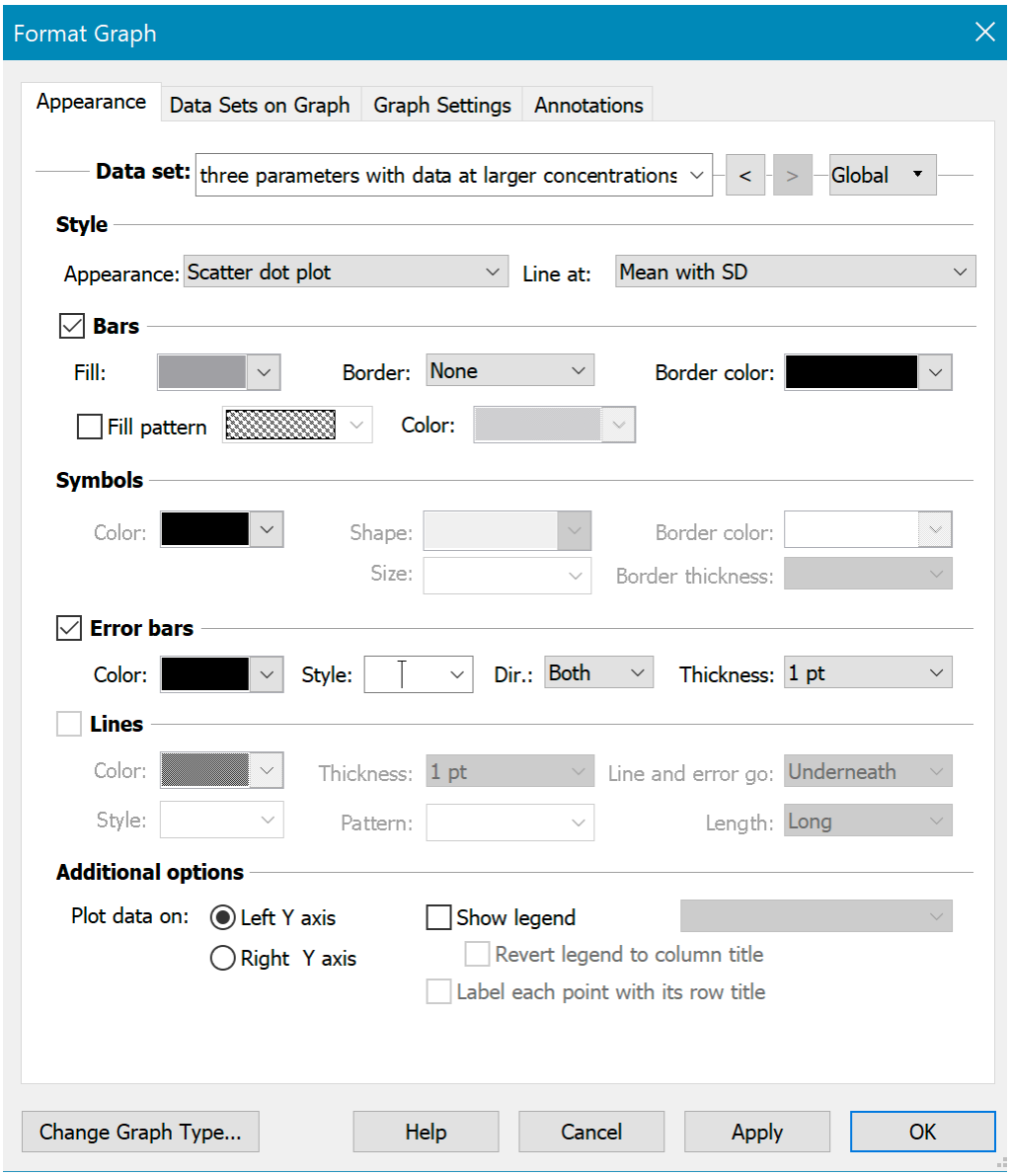
Double-click on any graph symbol or bar to open the Format Graph dialog.



To change the settings for one data set:

Select a data set from the list, and choose the bar format and fill, lines, and error bars for that data set. Then select another data set and choose settings for that data set. Click OK to redraw the graph with all the changes. Note that a fitted curve is treated as a separate data set.

To change all or some data sets on the graph (for example to make all symbols larger):

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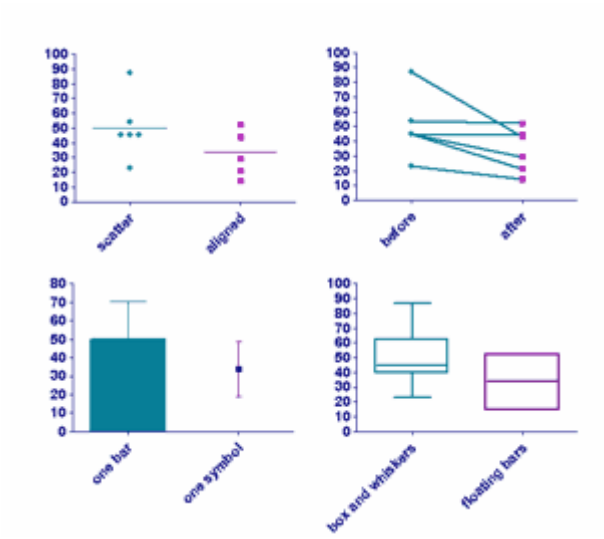
Drop the list of data set names and choose --Change ALL data sets--. Or click the Global button just to the right. Changes you make after that will then apply to all data sets, or to data sets you select from the Global button.

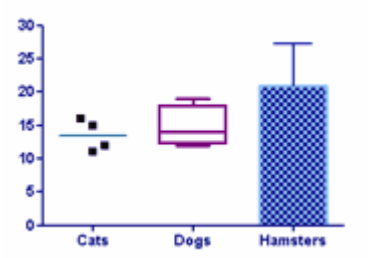
Style

Choose how you want to display your data for each data set. Choose from a simple bar (with or without error bars), a scatter plot, an aligned dot plot, box and whiskers, before and after plot, or floating bars. Also choose how to plot error bars. Select SD, SEM, 95% CI, or range.

Note that your choice applies to only one data set column unless you used the global button to choose all or a subset of columns.



It can also be useful to use different styles for each bar of a graph, as below:



Or connect data sets A and B as before-and-after and data sets C and D, but not B and C.

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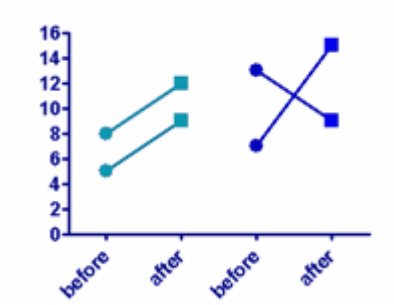
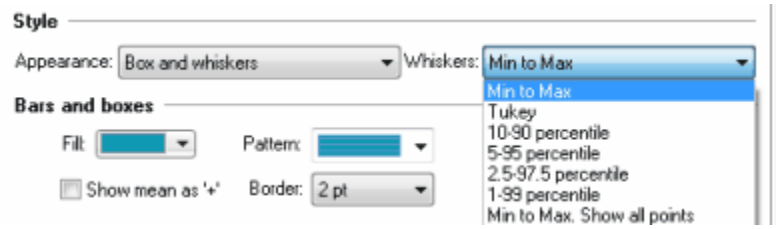


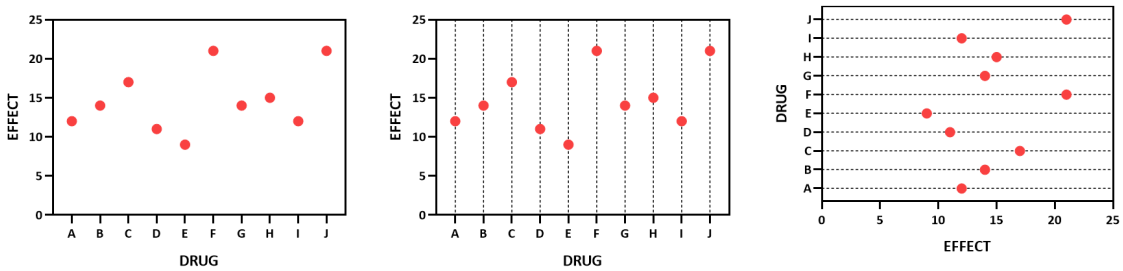
To do this, choose **Before-and-after** as the style for data sets A and C, and **Aligned dot plot** as the style for data sets B and D.

There are seven ways to plot **box-and-whisker graphs**. Traditional Tukey whiskers go 1.5 times the interquartile distance or to the highest or lowest point, whichever is shorter. Other choices show specified percentiles, which seems more logical. Any data beyond these whiskers are shown as points. Or you can choose to superimpose each individual point on the box and whisker plot. You need to have at least four values in order to create a box-and-whiskers graph.

Because whiskers can be done in various ways, it is essential to mention in a graph's figure legend which way they were made.



You can also plot "Symbol (one symbol per column)" and specify mean or median. This kind of graph looks better if you add a grid line from the first tab of the Format Axis dialog and flip it to be horizontal.



Bars and boxes

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Set the format of bars and the box part of box-whisker plots. If you check the option to use a fill pattern, you can then choose the type of fill pattern you want and what color to use.

Symbols

Choice here apply to symbols used for column scatter and before-after graphs, as well as the symbols shown (if any) on box-and-whisker plots.

If you check the option to plot a symbols on a bar graph, every value will be plotted. If you check the option to plot symbols on a box-and-whiskers plot, the number of symbols is chosen in the drop-down in the Whiskers section at the top of the dialog (see above). You can choose to plot all points (last choice in the list) or only to plot "outliers" defined in various ways.

Error bars

Choose the format and color of error bars. Learn more about error bars 370
.

Lines

Choose the color and thickness of lines for means on scatter plots and the connecting lines on before and after plot.

Plot on which Y axis

Specify which axis to use for each data set. This is useful if you want to show different type of data on the same graph. If you choose to plot on the right Y-axis, Prism will create that axis if it doesn't already exist.

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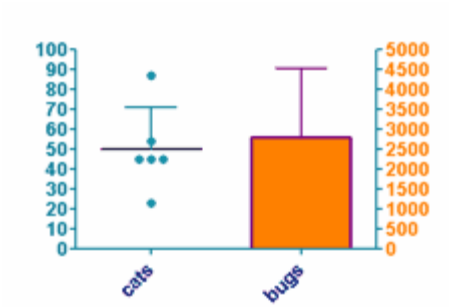
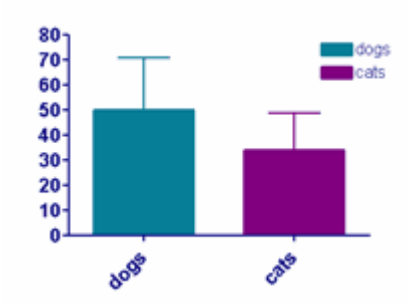


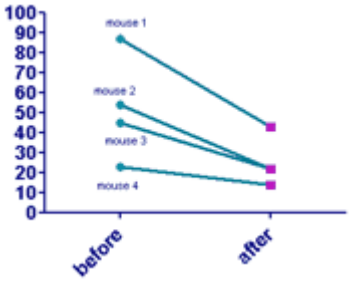
Legend

Select Show legend to create a legend for this data set. You can edit the labels in the legend. Double-click on the legend text and type whatever you like. Use the Revert Legend to Column Titles checkbox in the Legend section of the Format Graph dialog to change the labels back to match the column titles. (This checkbox is only available if you have edited a legend.)



Label each point with its row title

On before and after plots and scatter plots, you can choose to have X labels show on the graph to identify individual data points. Check this box to include X titles on graph near each data point. Select each label on the graph and drag it to move it where you want.



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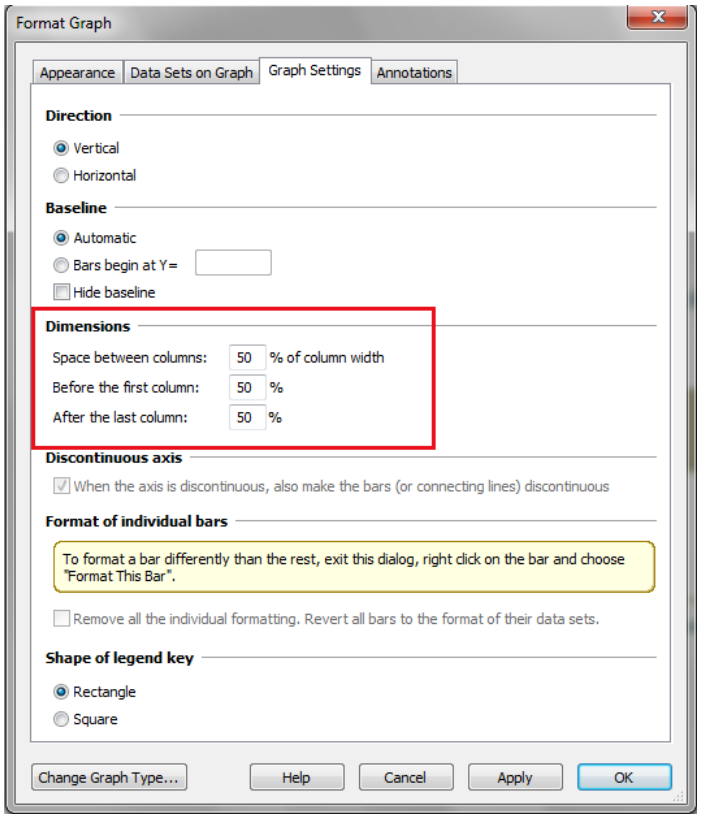
14.4.3.2 Data set spacing on Column graphs

Set the standard spacing between columns

To change the standard spacing between individual bars (or array of column scatter points), go to the Graph Settings tab. If you enter a larger value, the gaps between bars will be wider so the bars will be narrower. You can also set the gap before the first and after the last column.



The values you enter here are widths as percentages of column width

Changing the spacing between selected columns

To change the space between two adjacent bars, go to the Data Sets on Graph tab. Select a data set and enter (at the bottom of the dialog) the percentage of normal spacing you want between that data set and the prior one. If you enter 200, that bar will be twice as far from its left

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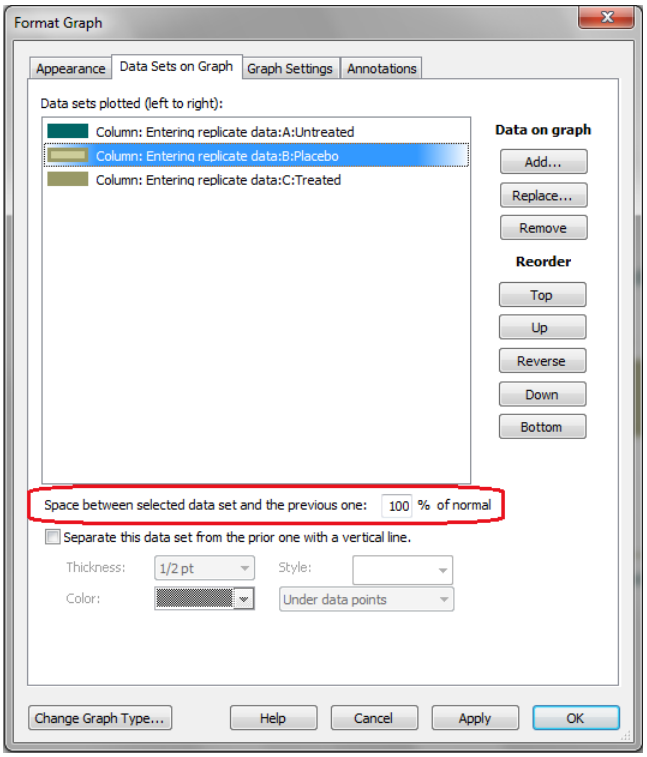
neighbor as the others. If you enter 50, it will be half as far. If you enter 0, this bar will touch the neighbor on the left.



Note one possible source of confusion.

When you enter a value here as the space between a selected data set and the prior one, you enter the percentage of the gap set in the Graph Settings tab. If you enter 200%, you are setting the gap between the selected data set and the prior one to be twice as large as the usual gap.

When you enter a value on the graph settings tab as space between columns, enter the percentage of the width of the bar (or plotting area for the set of scatter symbols). A value of 50%, means the gaps between bars are half as wide as the width of the bars.

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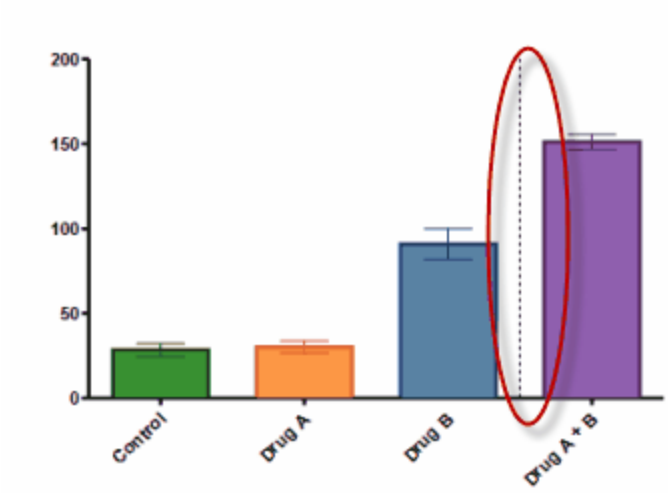
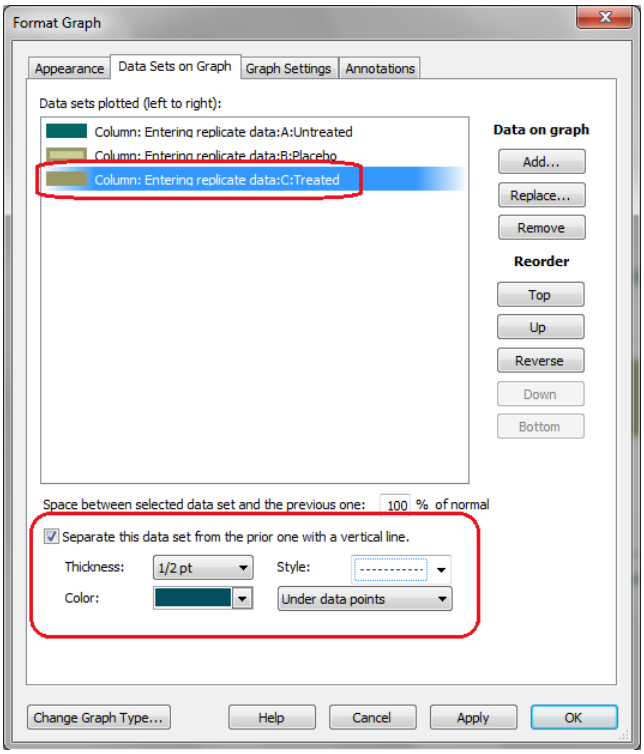
Adding a line between adjacent columns



To add a line between two adjacent bars, go to the Data Sets on Graph tab. Select a data set and enter (at the bottom of the dialog) the specifications of the line you desire.



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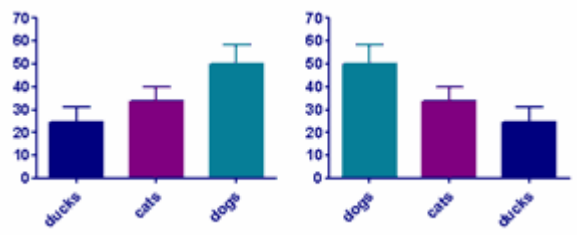
Empty columns

An alternative way to leave a gap is to create an additional data set column on the data table, enter only a single number (usually 0), and include it on the graph. If the baseline of the graph is 0.0, and that value is 0.0, then Prism will draw a zero height bar, which is essentially a gap.

14.4.3.3 Plotting order of Column graphs

The two graphs in this example are identical except that the plotting order was reversed.



To reverse the plotting order of the data sets on a graph, click the Rotate/Flip butto

To fine tune the left-to-right order, go to the Data Sets on Graph tab of the Format Graph dialog.

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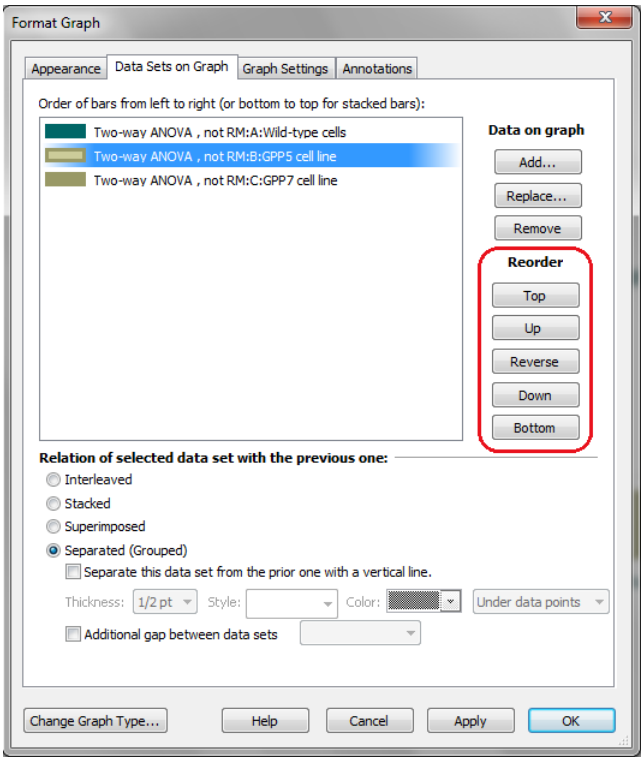

Changing the order of the data sets on this dialog changes the left-to-right order of the data sets on the graph. It does not change the order of the legends 356.

14.4.3.4 Additional Column graph settings

Graph Settings tab of Format Graph dialog

Use the Graph Settings tab of the Format Graph dialog to change the direction of bars on a graph from vertical to horizontal, to set the baseline for graph columns, and to adjust the space between columns. Double-click on any bar to open the dialog.

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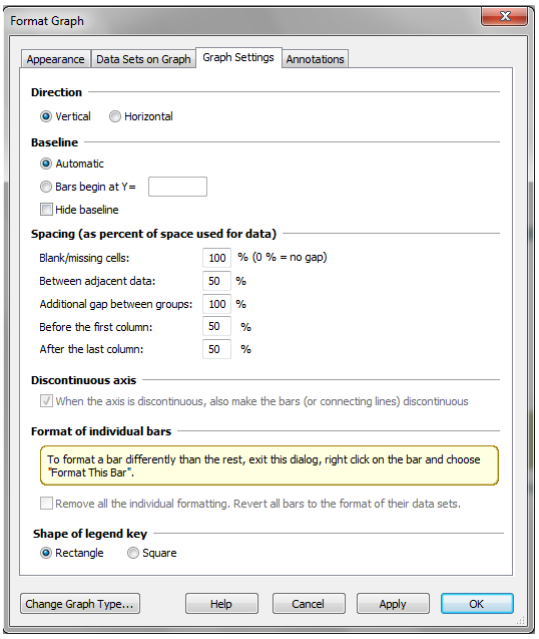
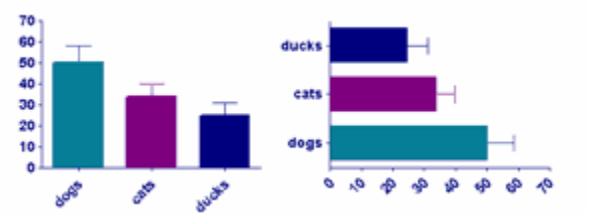


Rotate columns from vertical to horizontal



You also can use the Rotate button.

Baseline

Fill in this box to change the baseline for bars on a graph. The default is for the bars to begin at the X axis.

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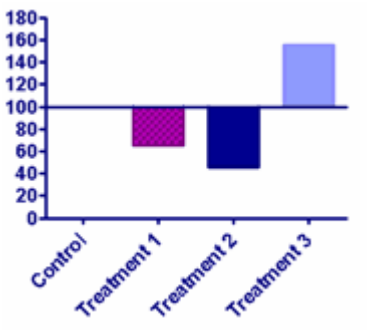
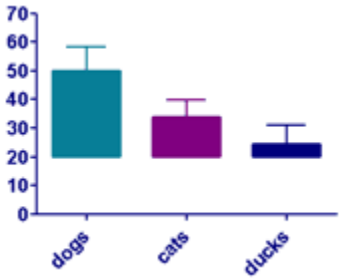
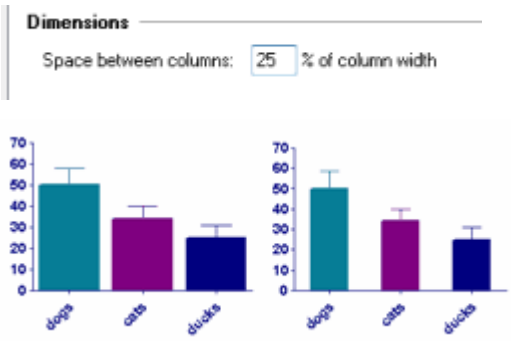


Check the box for "Hide Baseline" if you want your bars to float as in the example below.



Dimensions

Prism automatically adjusts the width of columns based on the size of the graph, the number of data sets, and the gap between bars which you set here. To make the columns wider, make the spacing smaller.



Discontinuous axis

When you have a gap in a Y axis, choose whether or not you also want a gap in any columns that span the gap.

Reset any individual bar formatting

If you have changed the format of individual bars (by right clicking on them 351) , check an option here to reset everything back to the format set in the dialog.

Shape of legend key

If you are plotting bars and chose to have a legend key, then choose here if the box showing the bar color and fill should be square or rectangular.

14.4.3.5 Forest plots

This graph below is a Forest plot, also known as an odds ratio plot or a meta-analysis plot. It graphs odds ratios (with 95% confidence intervals) from several studies.

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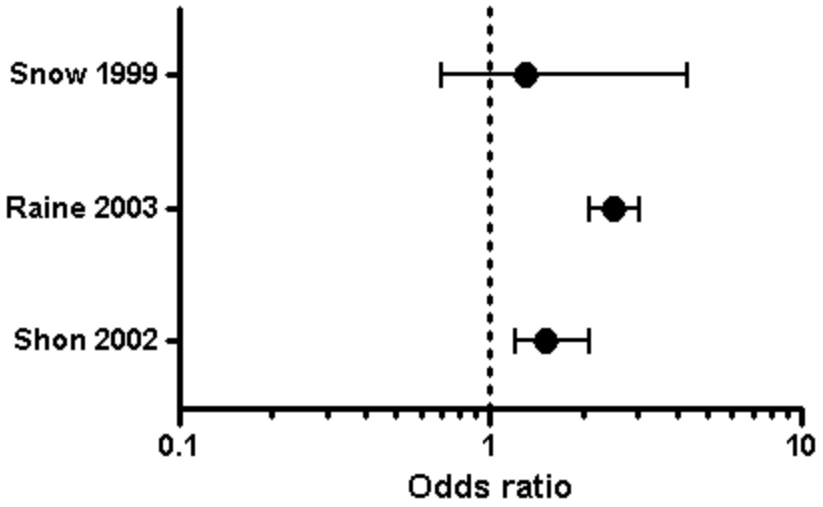

There are a few tricks to making this graph:

1. Enter the data into a Column table. Keep the default choice to enter the "replicates" into columns. (In this case, they are not replicates, but Prism thinks they are).

2. Enter the results for each study into a separate data set column. Enter in each column the Odds ratio itself, as well as the high and low confidence limits (computed elsewhere). The order of those three values doesn't matter. Label the studies by entering column titles. You may use Greek symbols, super and subscript, etc.

	A	B	C
	Snow 1999	Sohn 2002	Raine 2003
	Y	Y	Y
1	0.7	1.2	2.1
2	1.3	1.5	2.5
3	4.3	2.1	3.0

2. Go to the graph.

3. When you first go to look at the graph, Prism will prompt for the kind of graph you want. Choose "Column Mean with error bars".

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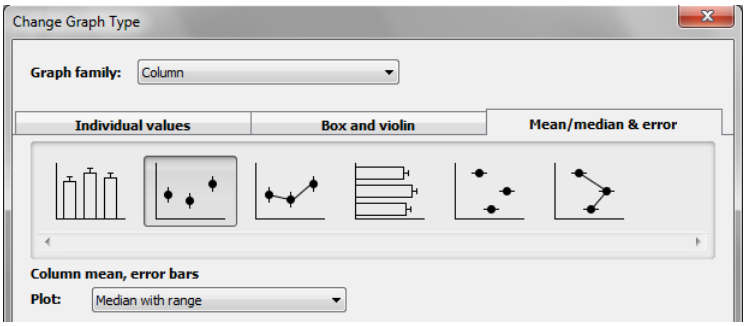
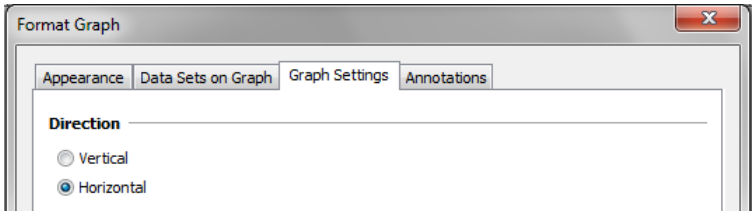


4. Note that Prism's doesn't (can't) know that each column contains a computed odds ratio along with the low and high confidence limits. It just sees three values. So choose to plot the median and range. The median and range of the three values you entered *are* the odds ratio and its confidence limits computed elsewhere. If you choose to plot a confidence interval instead, Prism will compute a confidence interval from the three values you enter and the results will be nonsense.

5. The default graph is vertical. To make the graph horizontal (as below), double click on the graph to bring up Format Graph, and go to the third tab.



6. Double-click on the X axis to bring up Format Axis. Choose to make the axis scale logarithmic with log spaced minor ticks, and to create a grid line at X=1.0.

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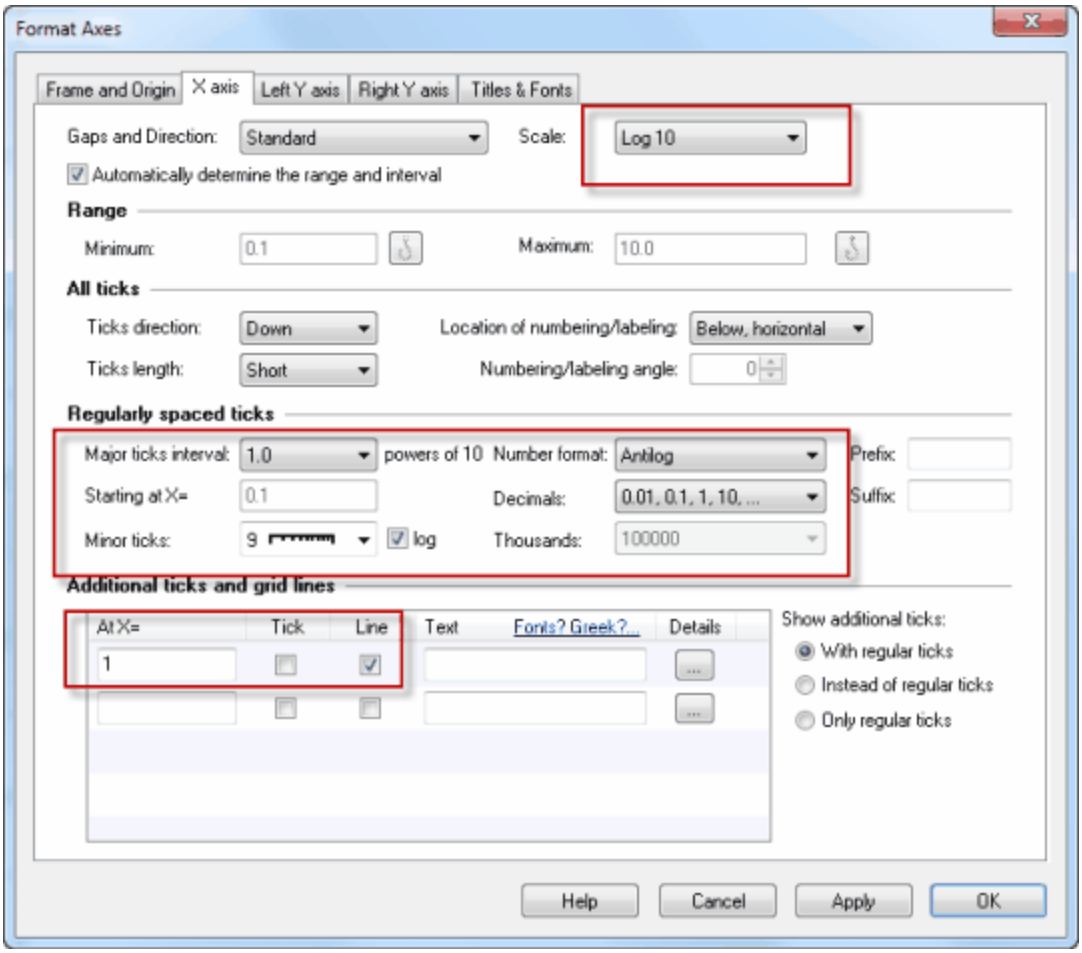

14.4.3.6 Color coding column scatter graphs

When you make a column scatter graph with Prism, all symbols in each column have the same shape and color. This page explains how to make some points have a different color.

Choose selected points in the table

1. Select a range of data, perhaps one row or one subcolumn.

2. Right click, choose Format Points, and then Symbol color

Notes:

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- If you have more than one graph from the same data, Prism will ask whether you wish to change one or all graphs.
- There is no way to create a new legend using this method to explain what the colors mean.

Change selected points on the graph

1. Make a column scatter graph as usual.
2. Right click on a point, choose Format This Point, and choose a different color.
3. Repeat for each point you want to change.

Make a Grouped graph instead (to get a legend)

1. Create a Grouped data table, and choose a Grouped Column Scatter graph.
2. Enter data on a Grouped data table, rather than a Column table. Put the values you want to have different colors into different data set columns. Put the values you want to appear in different columns of the graph into different rows.

Example:

Table format: Grouped		Group A					Group B				
		Wild-type cells					GPP5 cell line				
		A:Y1	A:Y2	A:Y3	A:Y4	A:Y5	B:Y1	B:Y2	B:Y3	B:Y4	B:Y5
1	Serum starved	34	36	41		43	98	87	95	99	88
2	Normal culture	23	19	26	29	25	32	29	26	33	30

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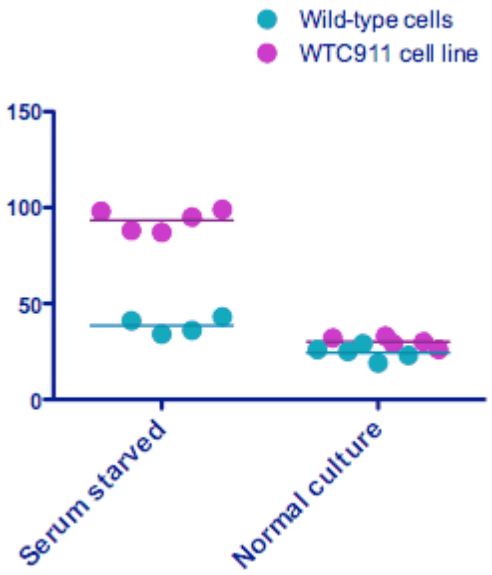

14.4.4 Grouped graphs

Format graph: Grouped and contingency

Prism lets you change every feature of a graph. Change the shape, color, and size of graph symbols; change the fill pattern and color of graph columns; change the order that data sets are plotted.

Double-click on any symbol or bar (or the background of the graph) to bring up the Format Graph dialog.

See also:

Appearance of Grouped and Contingency graphs 439

Data set grouping and spacing on Grouped graphs 445

Plotting order of Grouped graphs 449

Additional Grouped graph settings 452

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14.4.4.1 Appearance of Grouped graphs

Format Graph dialog - Grouped graphs

Use this dialog to change the look of all the columns in a data set. If you want to change the look of a single column 351, use the right-click menu. You can also change all the symbols in selected data sets 351.

Double-click on any graph symbol or bar to open the Format Graph dialog.

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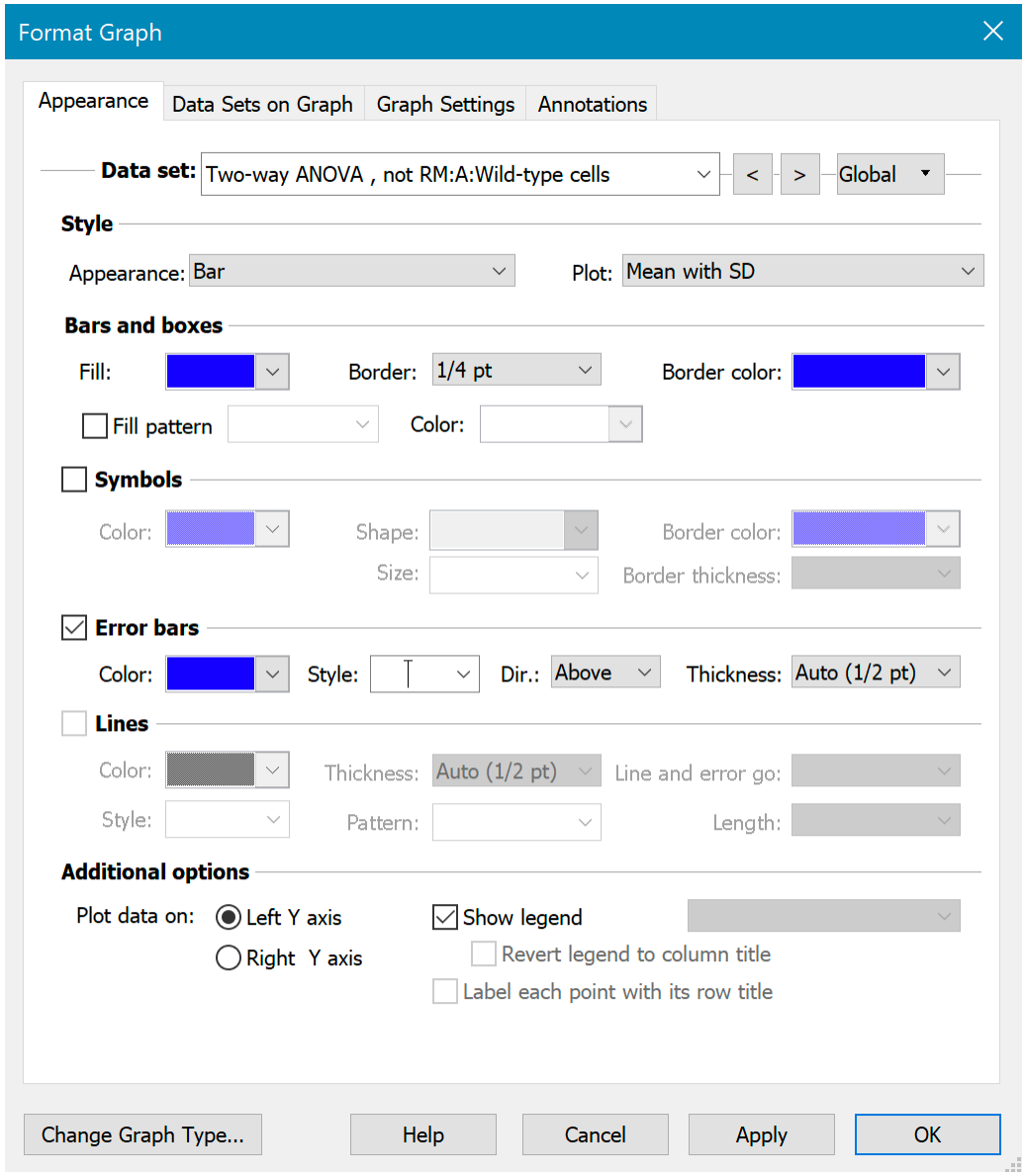

Global settings

To change the settings for one data set:

Select a data set from the list, and choose the symbols, lines, and error bars for that data set. Then select another data set and choose settings for that data set. Click OK to redraw the graph with all the changes. Note that a fitted curve is treated as a separate data set.

To change all data sets on the graph (for example to make all symbols larger):

Click the Global button and choose, Change all data sets. Changes you make after that will then apply to all data sets.

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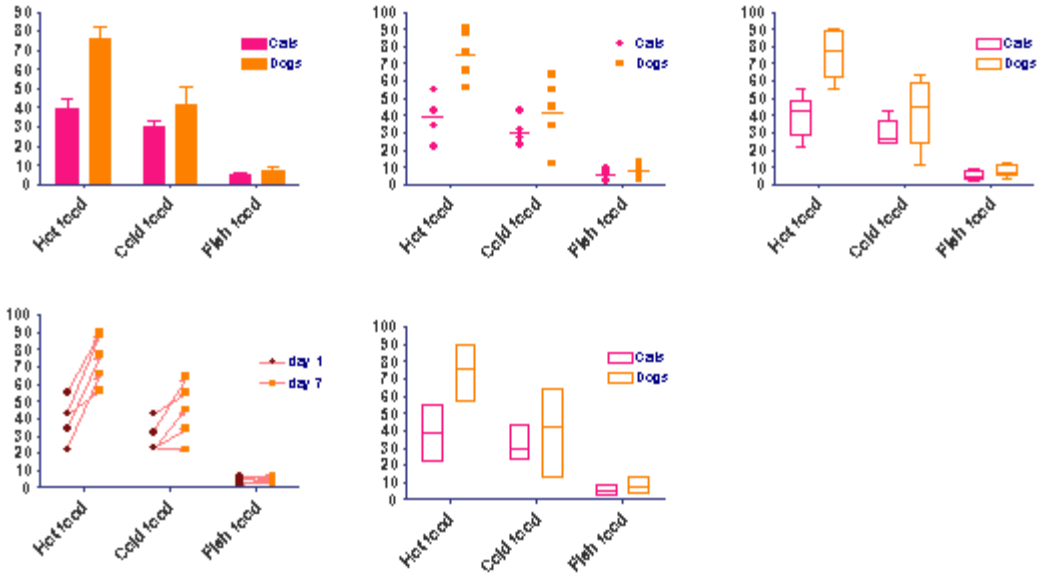
Bars and boxes

With two-grouping variable graphs, replicates are placed in side-by-side columns on the data table. One grouping variable is the main column heading, the other is the row title.

Table format: Two-way		A		B	
		cats		dogs	
		A:Y1	A:Y2	B:Y1	B:Y2
1	dog food	12	33	22	33
2	cat food	22	34	65	44
3	fish food	44	33	33	44

Choose how to display a data set on the graph. Choose between a scatter dot plot, an aligned dot plot, a before-and-after plot, a column or bar, a box-and whiskers plot, or a floating bar showing the minimum and maximum.



Choose how to plot error bars. Select SD, SEM, 95% CI, or range. Your style choice will determine which options below you can use. Since it rarely makes sense to choose different error bar (or replicate) choices for different data sets, you will probably want to click "All" before changing error bar format.

Symbols

If you choose to plot data as a scatter dot plot or a before-and-after graph, select the symbol type, size, and color. If you pick an open

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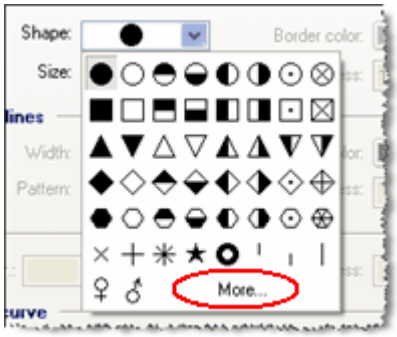
symbol, also select a border thickness. Check the Clear option if you want point-to-point lines and overlapping points to show through the open symbol.

Click More to use any character from any font as a symbol.



If you choose to plot your data sets as bars, columns, box-and-whiskers, or floating min/max boxes, choose the color, outline and fill of the bars and boxes.

Use the Data Sets on Graph tab 445 to adjust the spacing between bars, and whether you want the bars stacked, interleave, grouped, or superimposed.

Prism labels bars with the row titles from the data table. You may not edit the bar titles directly, but if you edit the row titles, the graph will update. Use the Format Axes 494 dialog, not the Format Graph dialog, to turn off the labels or to change to vertical or angled labels.

If your data table has only one row, Prism will place the column titles, rather than row titles, under each bar.

Error bars

Choose the format and color of error bars. Learn more about error bars 370 .

Lines

Choose the format of lines connecting data points for a before-and-after plot. Consider using arrows.

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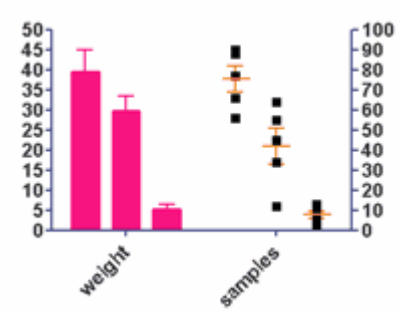
Plot on which Y axis

Specify which axis to use for each data set. If you choose to plot on the right Y-axis, Prism will create that axis if it doesn't already exist.



Legend

Select Show legend to create a legend for this data set. Prism automatically uses the column titles in your data table as legend labels. You can also edit the labels in the legend. Double-click on the legend text and type whatever you like. Use the "Revert Legend to Column Titles" checkbox in the Legend section of the Format Graph dialog to change the labels back to match the column titles. (This checkbox is only available if you have edited a legend.)

14.4.4.2 Grouped graphs with XY data

If you entered XY data, with values in the X column, you can make a Grouped graph. But note:

The whole point of a grouped graph, is that the X axis is spaced by row number. The X value does not determine the position of the points on the graph. This can be useful in some situations, but very misleading in others. As shown below, the X values may not even be plotted in order of their value. On a grouped graph, position is determined by row number only.

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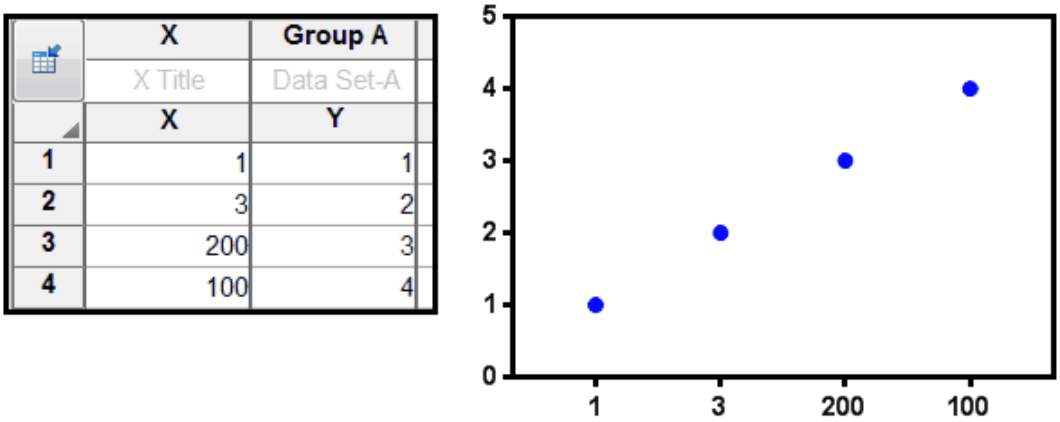
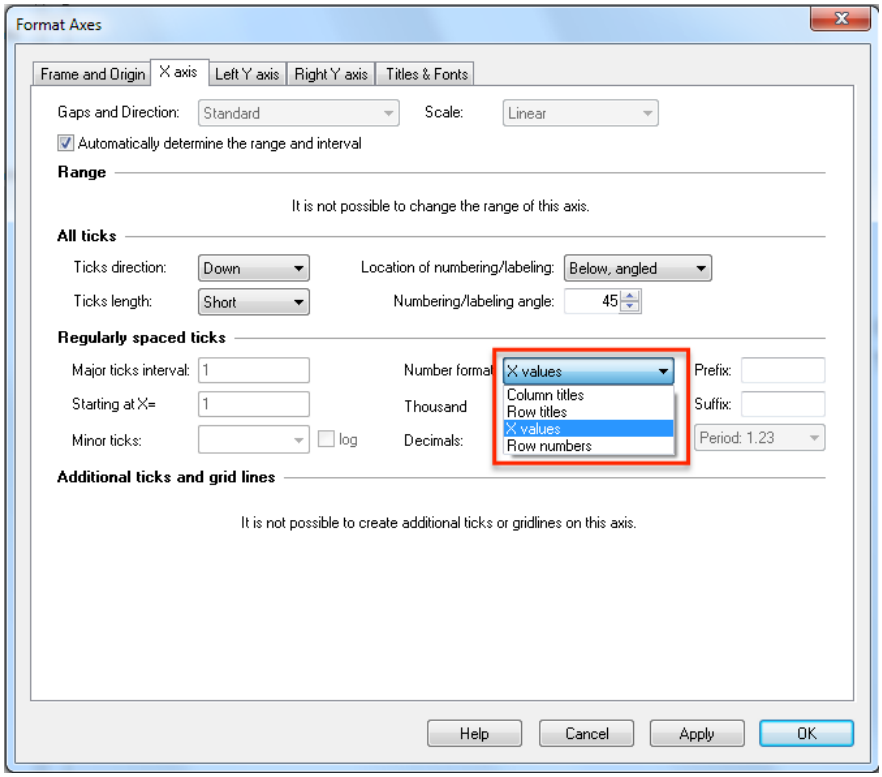


	X	Group A
	X Title	Data Set-A
	X	Y
1	1	1
2	3	2
3	200	3
4	100	4

The graph above has the X axis labeled with the X values. On the Format Axes dialog, you can choose to use Row titles (if you entered any), row numbers or column titles instead.



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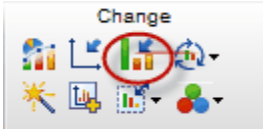
14.4.4.3 Data set grouping and spacing on Grouped graphs

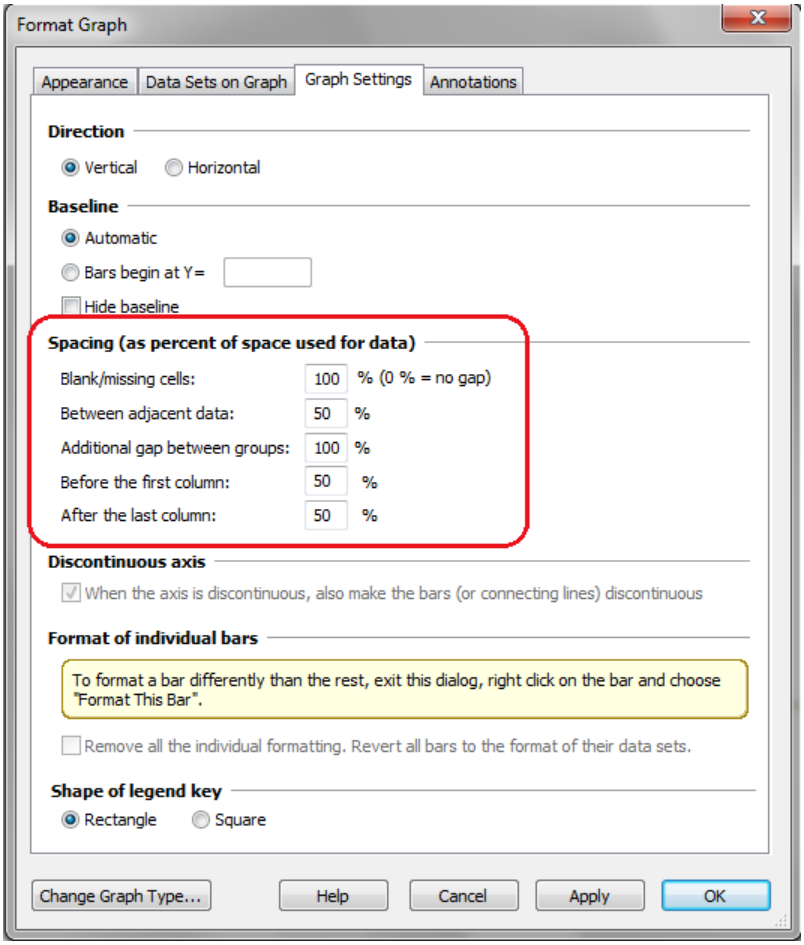
How do you change the grouping and spacing of bars on Grouped graphs?

Click on the Format graph button on the Prism toolbar or double-click on any data point to open the Format Graph dialog.



Set the standard spacing between data sets

To change the standard spacing between individual bars and groups of bars, go to the Graph Settings tab.



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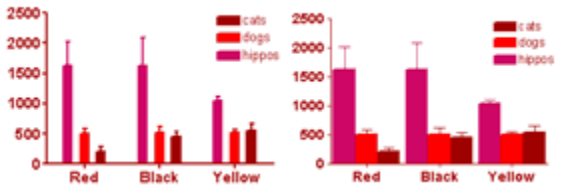
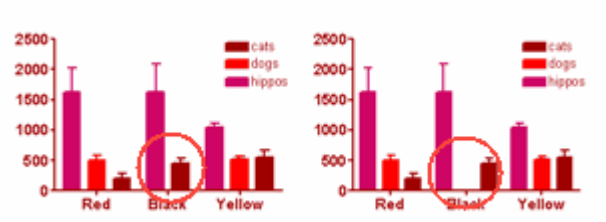
Use these settings to set adjust the spacing between columns on a graph, between groups of columns, and before the first column and after the last one. If you make the spacing smaller, the columns will become wider.



Choose how much if any space to leave for the bar where no value was entered (the cell is blank). In the example below, no data was entered for black dogs. You can choose to leave no space, normal 100% space, or something in between.



Note a possible point of confusion. The percentages set in this tab of the dialog specify spacing as percent of the "normal" width. The normal width is set in the by the number of data sets, number of rows and width of the graph.

Set how you want the bars to be grouped

You can change the overall grouping scheme of a graph or make hybrid graphs types using the order tab of the Format Graph dialog. For each data set, choose whether it should be interleaved with, stacked on top of, placed apart from the (starting a new group of bars, hence the name “grouped”) or superimposed on the preceding data set.

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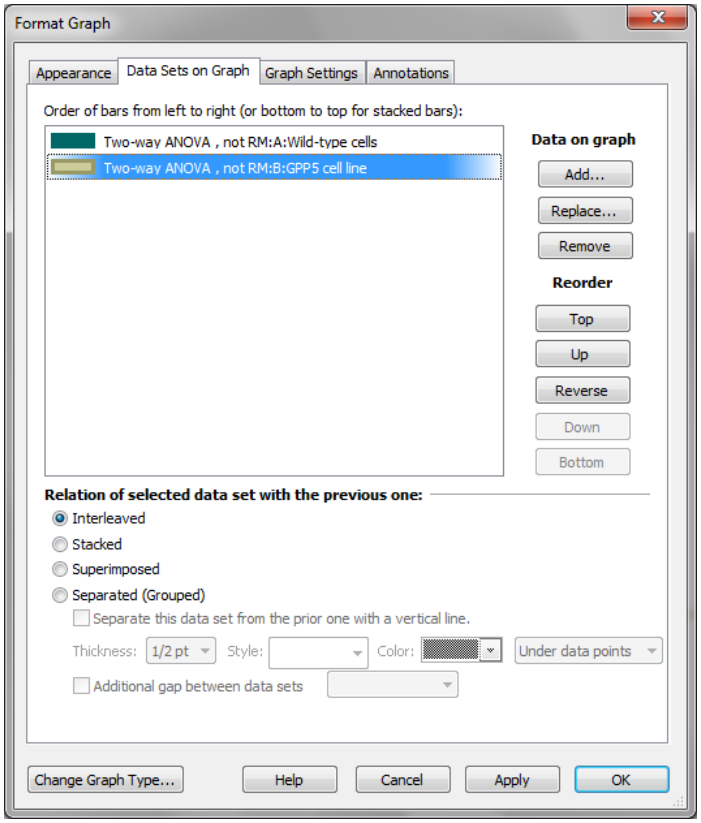
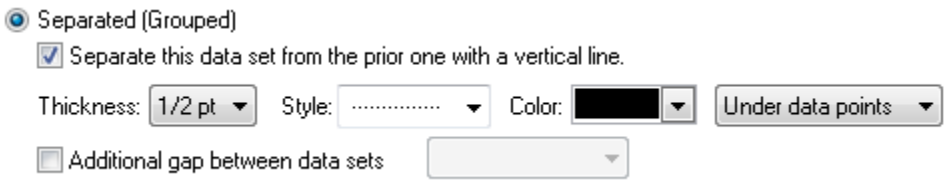


Add lines between groups

Check the box to Separate a data set from another with a line.



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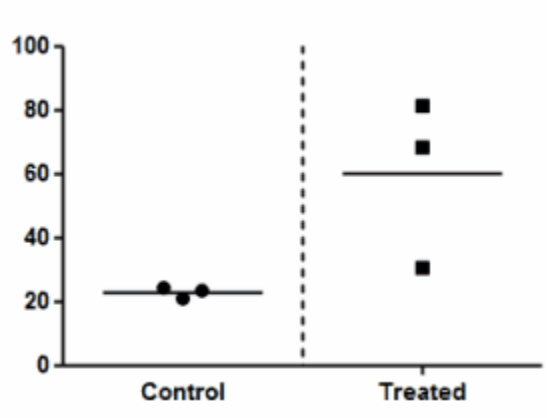
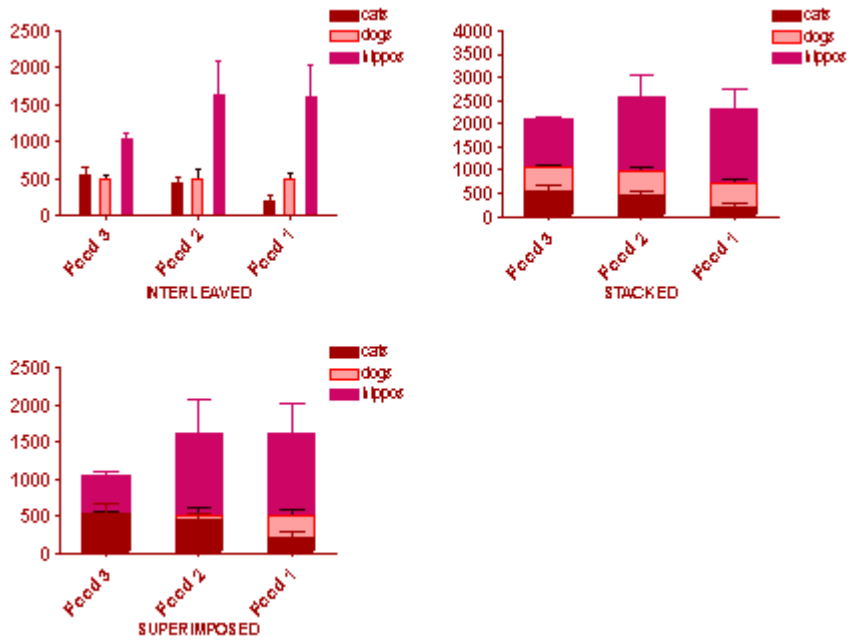


Stacked and superimposed bars

Note the difference between Stacked and Superimposed below. When the bars are superimposed, each extends from the X axis to the value. When bars are stacked, each bar starts at the top of the one below.



Notes:

- If bars are superimposed, it can help to use semitransparent colors. That way you can see the smaller bar that is hidden behind a taller one.

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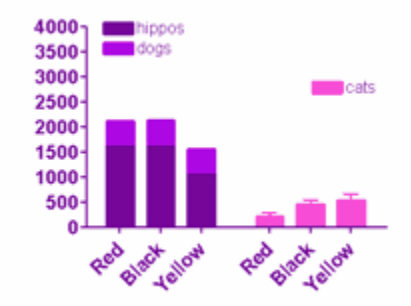
- Use the second tab of Format Graph to change the order of data sets, which controls which data set is on top.

- With stacked bars, each row in the data table becomes one stack of bars. If you want to leave a gap between stacks (to create a natural grouping of sets of stacked bars), leave a blank row in your data table.

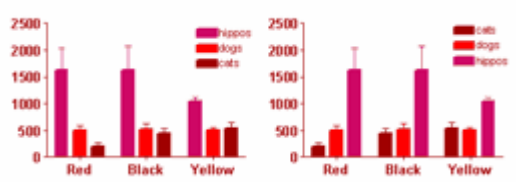
- It sometimes is helpful to combine both stacked and interleaved bars on the same graph as below. This is done by checking the option to stack the "dogs" data set on top of hippos, and to make the "cats" data set grouped.



14.4.4.4 Plotting order of Grouped graphs

Data set order

The two graphs in this example are identical except that the plotting order was reversed.



Click the Rotate/Flip button in the Change section of the Prism toolbar to reverse the order of data sets on a graph.

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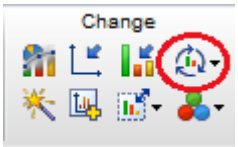
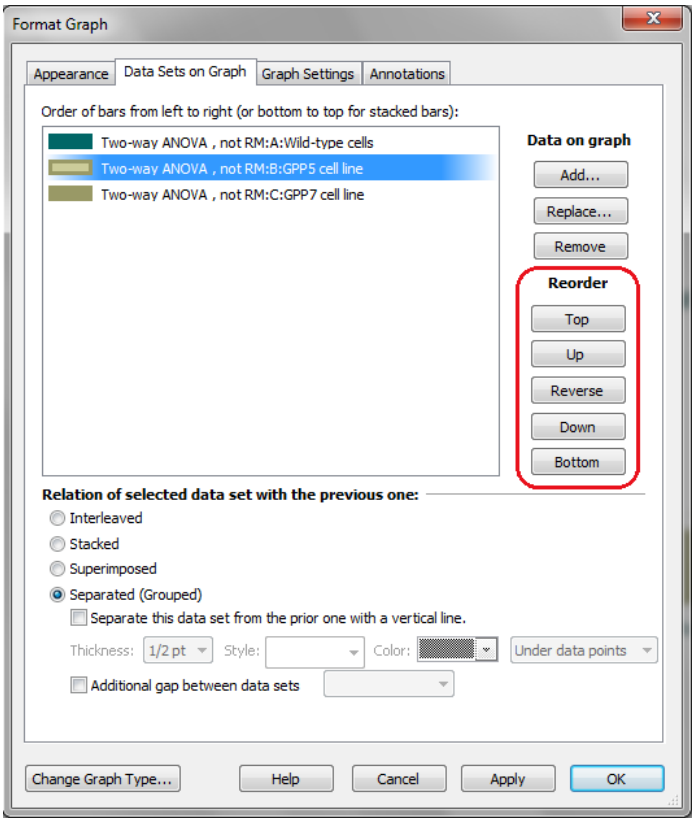
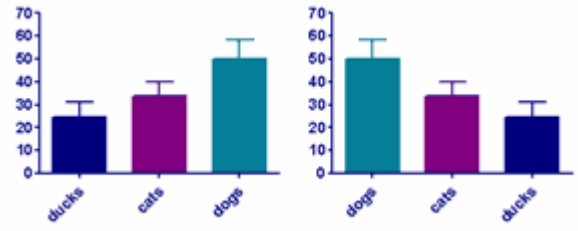


To fine tune the left-to-right order, go to the Data Sets on Graph tab of the Format Graph dialog.



The two graphs in this example are identical except that the plotting order was reversed.



To reverse the plotting order of the data sets on a graph, click the Rotate/Flip butto

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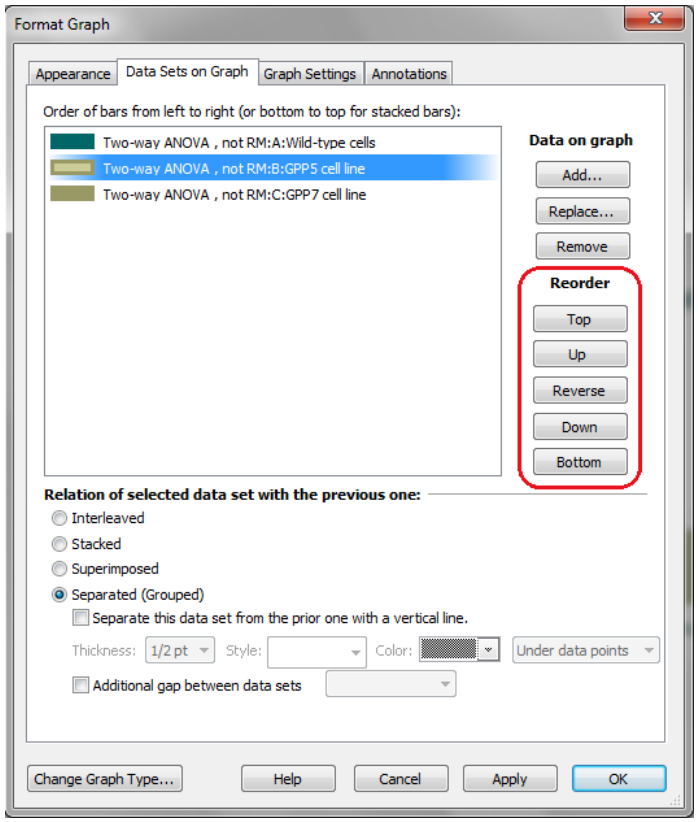
To fine tune the left-to-right order, go to the Data Sets on Graph tab of the Format Graph dialog.



Changing the order of the data sets on this dialog changes the font-to-back (if you plot symbols) or left-to-right (if you plot bars) order of the data sets on the graph. It does not change the order of the legends 356.

Order of bars within a data set

The previous section explained how to adjust the order of the data sets. The order of the individual columns within a particular data set is determined by the order they are entered in the data table.

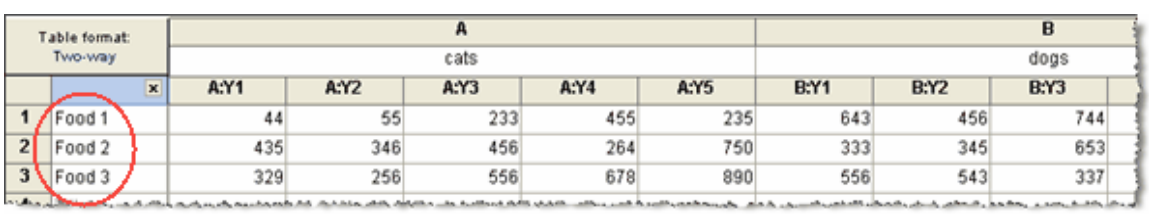


Table format: Two-way		A					B		
		cats					dogs		
		A:Y1	A:Y2	A:Y3	A:Y4	A:Y5	B:Y1	B:Y2	B:Y3
1	Food 1	44	55	233	455	235	643	456	744
2	Food 2	435	346	456	264	750	333	345	653
3	Food 3	329	256	556	678	890	556	543	337

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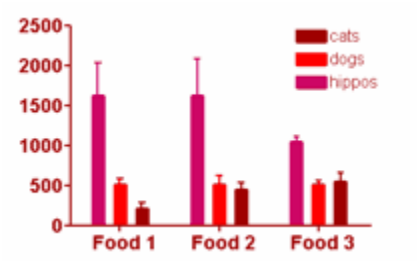
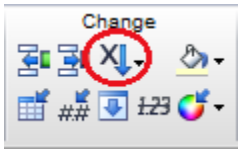


To reverse the row order on a data table, go to the data table. From the Change menu, click the Sort button, and choose "Reverse row order".



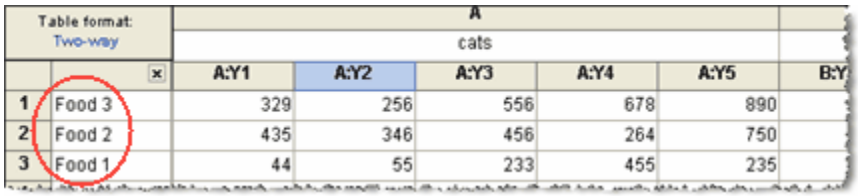
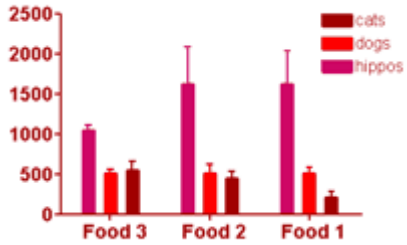


Table format: Two-way		A					
		cats					
		A:Y1	A:Y2	A:Y3	A:Y4	A:Y5	B:Y
1	Food 3	329	256	556	678	890	
2	Food 2	435	346	456	264	750	
3	Food 1	44	55	233	455	235	



See another example of changing plotting order for Grouped graphs. 249

14.4.4.5 Additional Grouped graph settings

Graph Settings tab of Format Graph dialog

Use the Graph Settings tab of the Format Graph dialog to change the direction of bars on a graph from vertical to horizontal, to set the baseline for graph columns, and to adjust the space between columns. Double-click on any bar to open the dialog.

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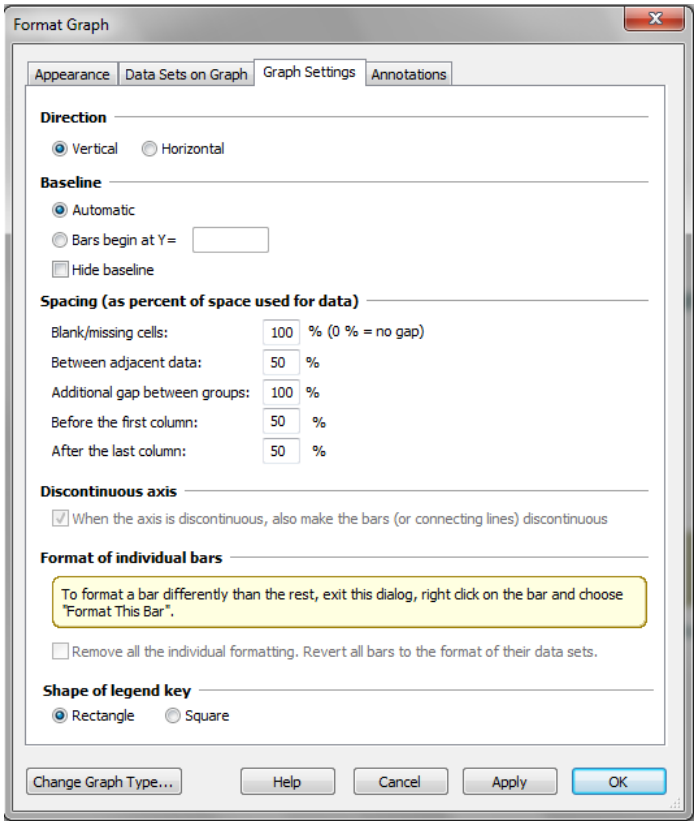
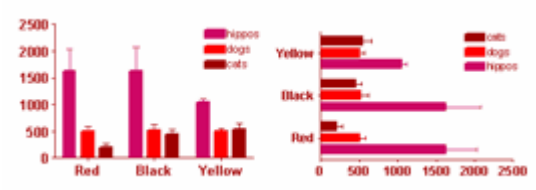


Direction

Rotate columns from vertical to horizontal



You also can use the Rotate button.

Baseline

Fill in this box to change the baseline for bars on a graph. The default is for the bars to begin at the X axis. Check the box for "Hide Baseline" if you want your bars to float as in the example below.

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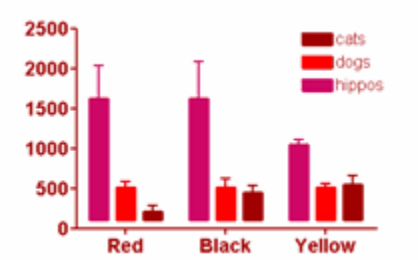
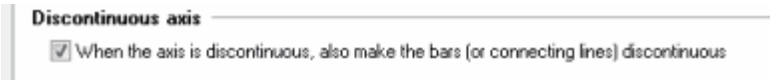


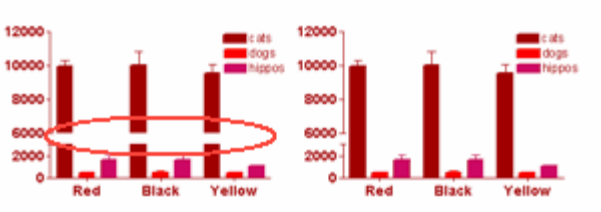
Spacing

This is explained in a separate help page 445.

Discontinuous axis

When you have a gap in a Y axis, choose whether or not you also want a gap in any columns that span the gap. Not leaving a gap may make your graph misleading.





Shape of the legend key

For bar graphs, choose between square or rectangular (wider) boxes before the legend text.

14.4.4.6 Row or column titles under bars?

You can change how the bars are labeled. Double-click on the axis to bring up Format Axis, then choose to use Row numbers, Row titles, or

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Column titles. If you choose Column titles, you'll want to use the text tool to add text to the graph to explain the grouping.

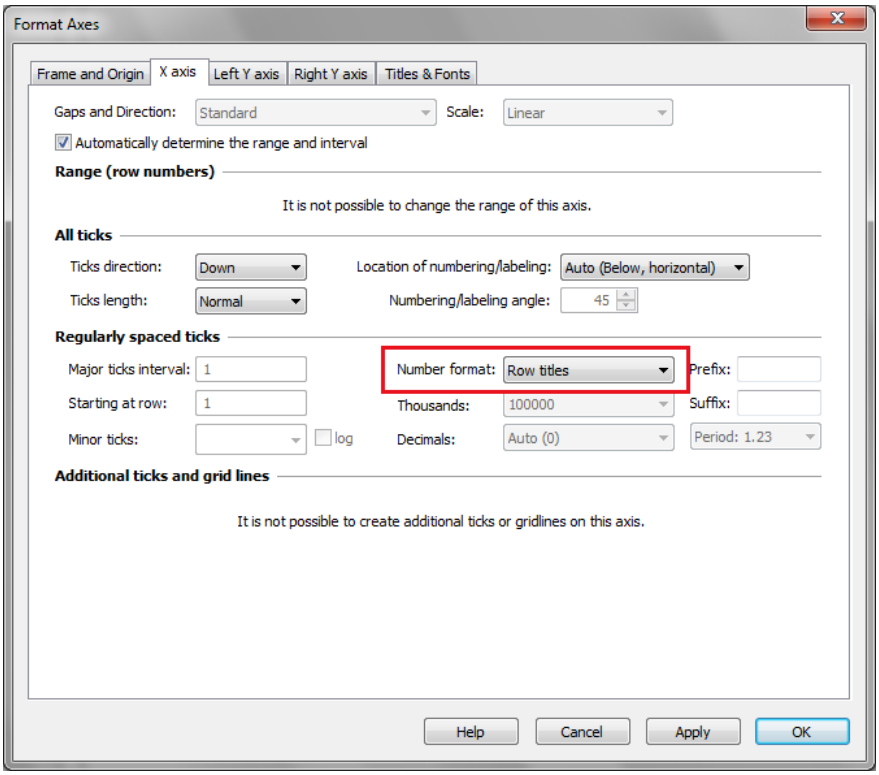

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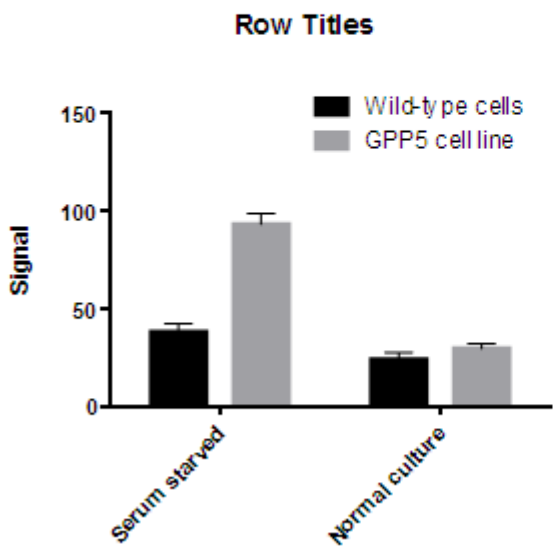
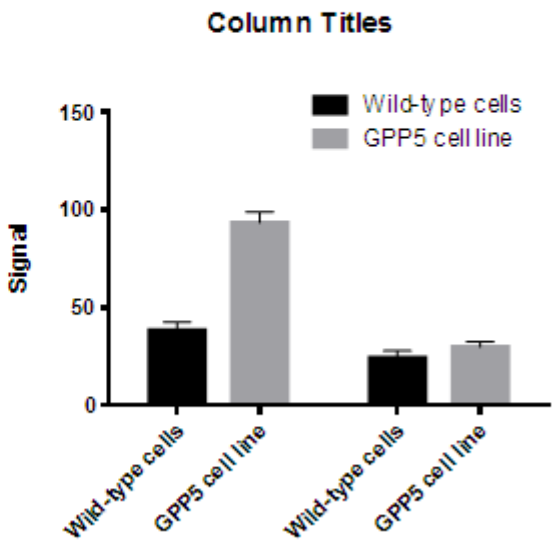
Table format: Grouped		Group A					Group B				
		Wild-type cells					GPP5 cell line				
		A:Y1	A:Y2	A:Y3	A:Y4	A:Y5	B:Y1	B:Y2	B:Y3	B:Y4	B:Y5
1	Serum starved	34	36	41		43	98	87	95	99	88
2	Normal culture	23	19	26	29	25	32	29	26	33	30





14.4.4.7 Plotting the grand mean or grand median

To plot the grand mean or grand median, plot grouped data (with individual replicates) on a Grouped graph, choose "Plot individual values" and then choose to plot a superimposed scatter plot. The last two choices on the Plot drop down menu will be to plot the Grand mean or Grand median. It is not possible to plot the grand mean or median with error bars, and it isn't totally clear even how those error bars would be defined.

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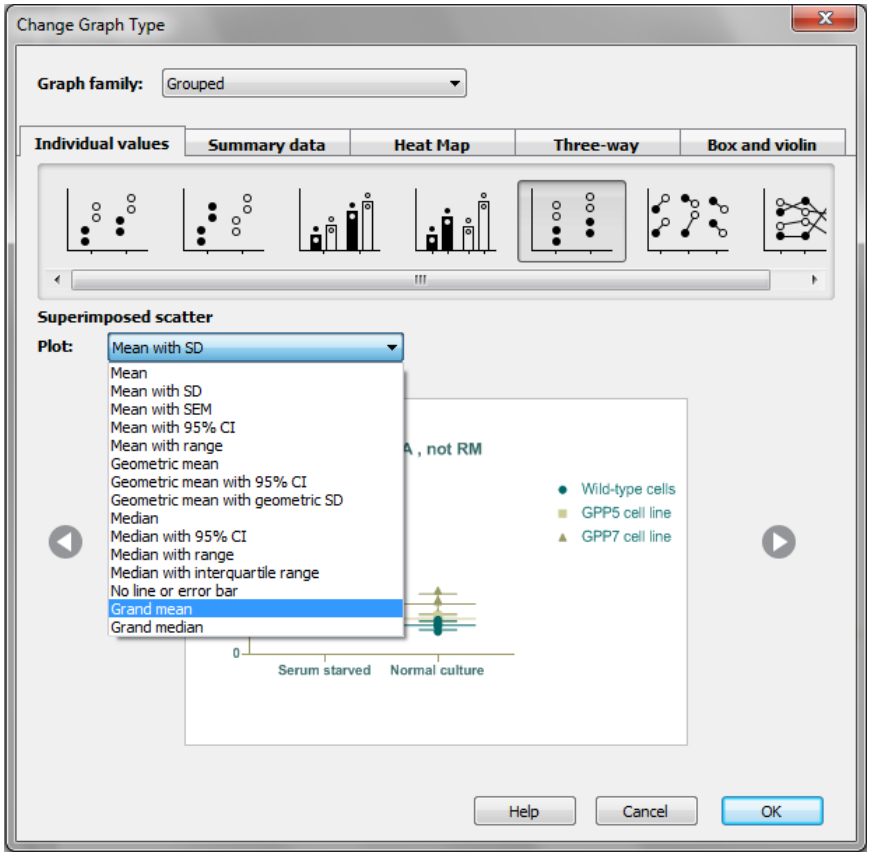

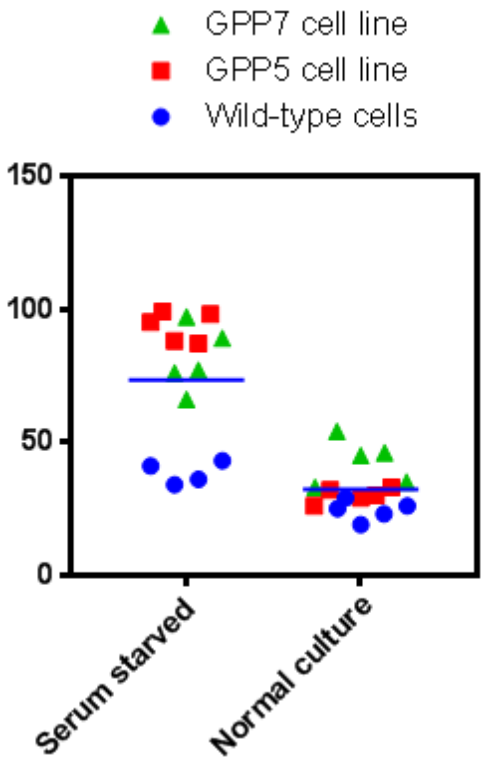

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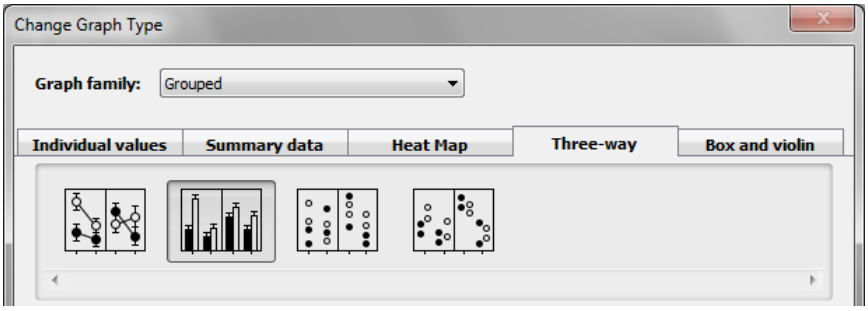
The data for the graph above were entered on a Grouped table with five subcolumns. The three kinds of symbols represent data from three data set columns. The two columns in the graph (serum starved and normal culture) come from two different rows in the data table.

14.4.4.8 Three way graphs

A three way graphs is a Grouped graph set up to show data entered into Prism for analysis by three-way ANOVA. The entered data look like this. Note the two line column titles. These are essential both to properly label the data, but also to properly label the graph.

Table format: Grouped		Group A			Group B			Group C			Group D		
		Low fat Male			Low fat Female			High fat Male			High fat Female		
		A:Y1	A:Y2	A:Y3	B:Y1	B:Y2	B:Y3	C:Y1	C:Y2	C:Y3	D:Y1	D:Y2	D:Y3
1	Light smoker	24.1	29.2	24.6	20.0	21.9	17.6	14.6	15.3	12.3	16.1	9.3	10.8
2	Heavy smoker	17.6	18.8	23.2	14.8	10.3	11.3	14.9	20.4	12.8	10.1	14.4	6.1

From the Change Graph Type dialog, choose the Three-way tab and one of the thumbnails.



The graph looks like this.

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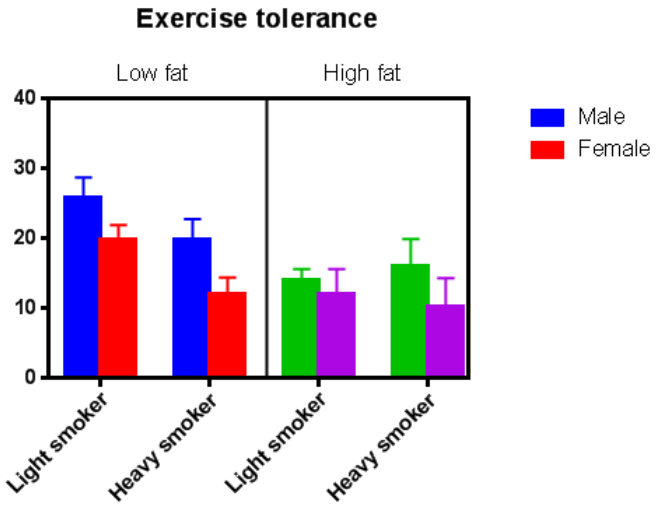

Note that the first line of the column titles in the data table become labels for the two halves of the graph, and the second line of the column title becomes the graph legend. The row titles become labels under the bars.

14.4.5 Contingency graphs

Format graph: Grouped and contingency

Prism lets you change every feature of a graph. Change the shape, color, and size of graph symbols; change the fill pattern and color of graph columns; change the order that data sets are plotted.

Double-click on any symbol or bar (or the background of the graph) to bring up the Format Graph dialog.

See also:

Appearance of Grouped and Contingency graphs 439

Data set grouping and spacing on Grouped graphs 445

Plotting order of Grouped graphs 449

Additional Grouped graph settings 452

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14.4.5.1 Appearance of Contingency graphs

Format Graph dialog - Grouped graphs

Use this dialog to change the look of all the columns in a data set. If you want to change the look of a single column 351, use the right-click menu. You can also change all the symbols in selected data sets 351.

Double-click on any graph symbol or bar to open the Format Graph dialog.

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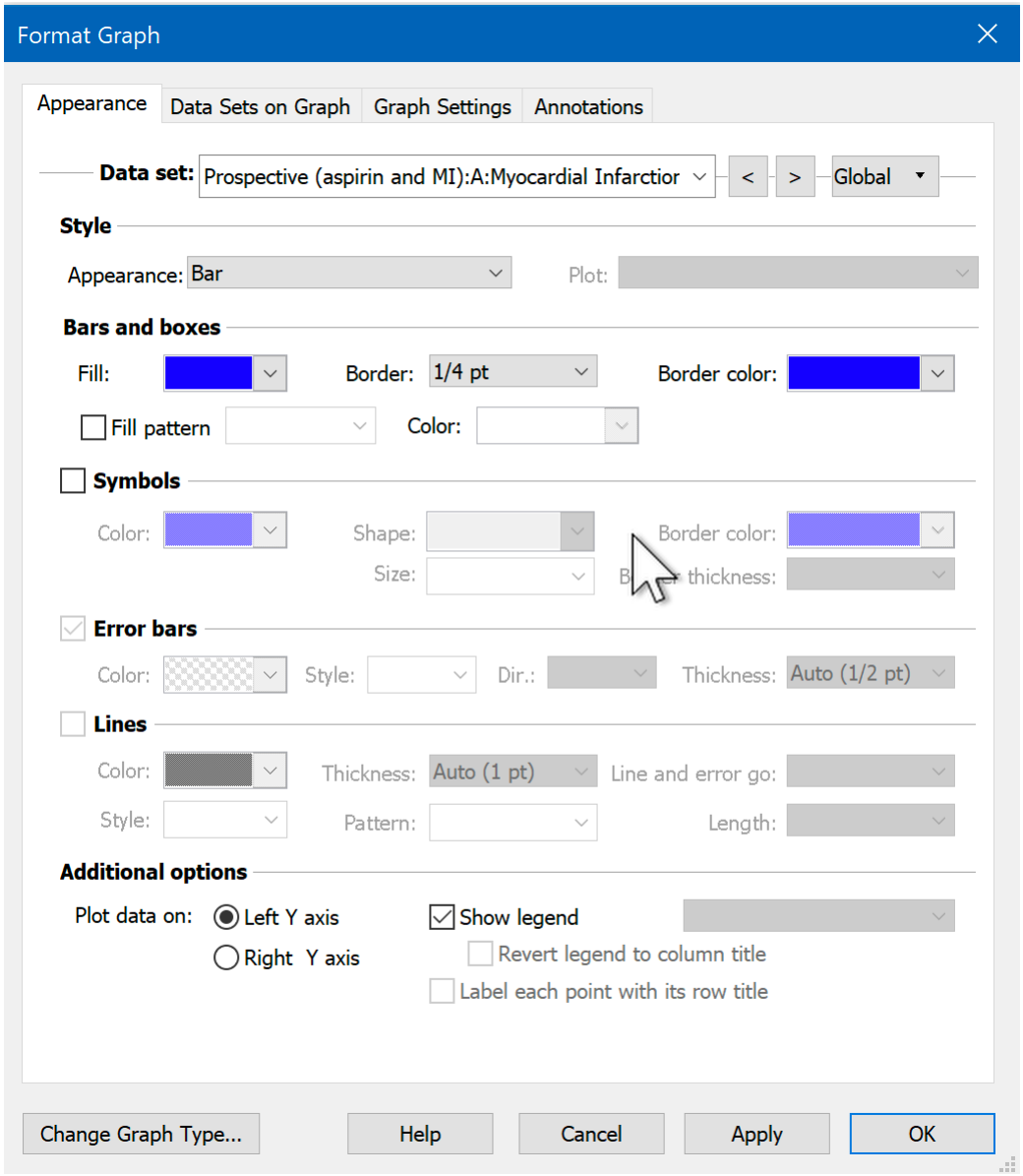

Global settings

To change the settings for one data set:

Select a data set from the list, and choose the symbols, lines, and error bars for that data set. Then select another data set and choose settings for that data set. Click OK to redraw the graph with all the changes. Note that a fitted curve is treated as a separate data set.

To change all data sets on the graph (for example to make all symbols larger):

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Click the Global button and choose, Change all data sets. Changes you make after that will then apply to all data sets.

Bars and boxes

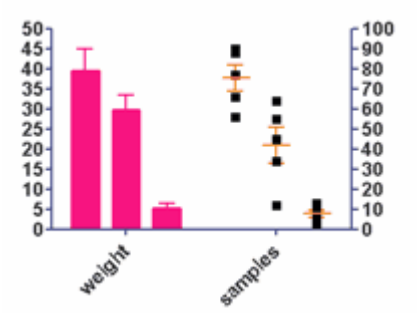
Plot bars (usually), symbols, or both (but why?)

Use the Data Sets on Graph tab 445 to adjust the spacing between bars, and whether you want the bars stacked, interleave, grouped, or superimposed.

Prism labels bars with the row titles from the data table. You may not edit the bar titles directly, but if you edit the row titles, the graph will update. Use the Format Axes 494 dialog, not the Format Graph dialog, to turn off the labels or to change to vertical or angled labels.

Plot on which Y axis

Specify which axis to use for each data set. If you choose to plot on the right Y-axis, Prism will create that axis if it doesn't already exist.



Legend

Select Show legend to create a legend for this data set. Prism automatically uses the column titles in your data table as legend labels. You can also edit the labels in the legend. Double-click on the legend text and type whatever you like. Use the "Revert Legend to Column Titles" checkbox in the Legend section of the Format Graph dialog to change the labels back to match the column titles. (This checkbox is only available if you have edited a legend.)

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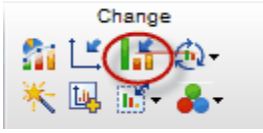
14.4.5.2 Data set grouping and spacing on Contingency graphs

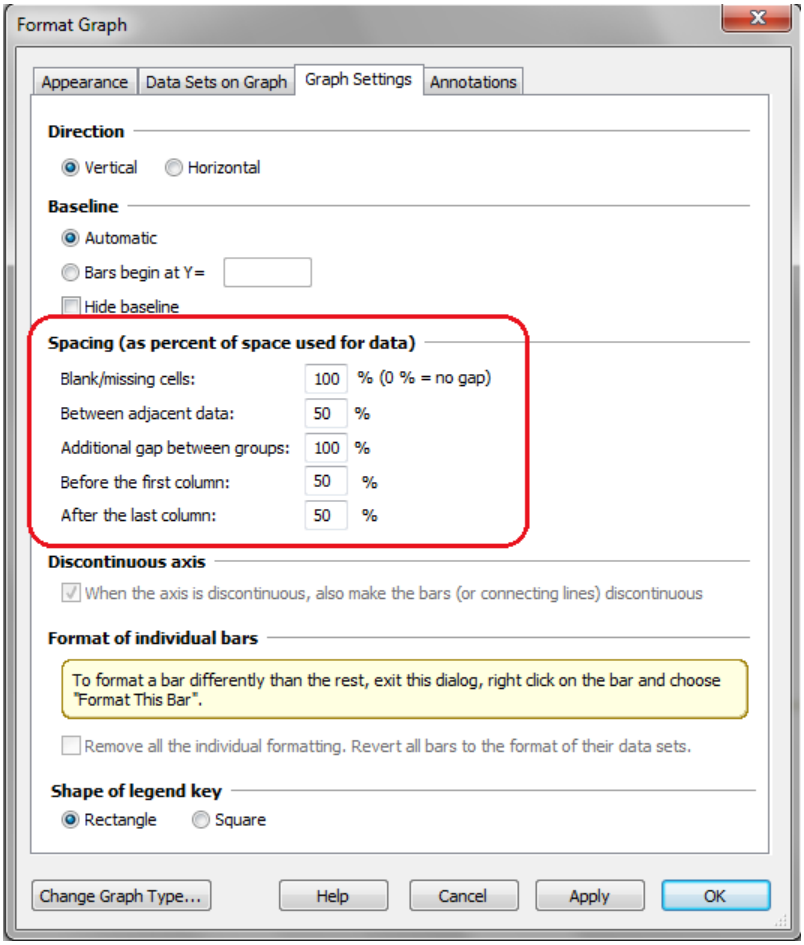
How do you change the grouping and spacing of bars on Grouped graphs?

Click on the Format graph button on the Prism toolbar or double-click on any data point to open the Format Graph dialog.



Set the standard spacing between data sets

To change the standard spacing between individual bars and groups of bars, go to the Graph Settings tab.



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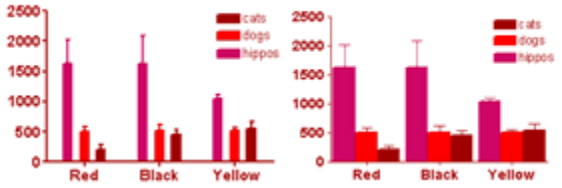
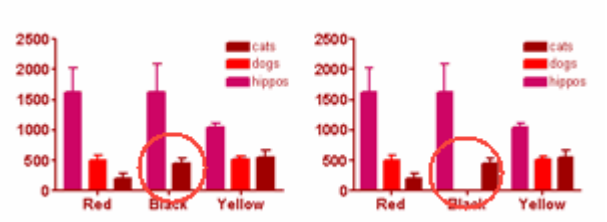
Use these settings to set adjust the spacing between columns on a graph, between groups of columns, and before the first column and after the last one. If you make the spacing smaller, the columns will become wider.



Choose how much if any space to leave for the bar where no value was entered (the cell is blank). In the example below, no data was entered for black dogs. You can choose to leave no space, normal 100% space, or something in between.



Note a possible point of confusion. The percentages set in this tab of the dialog specify spacing as percent of the "normal" width. The normal width is set in the by the number of data sets, number of rows and width of the graph.

Set how you want the bars to be grouped

You can change the overall grouping scheme of a graph or make hybrid graphs types using the order tab of the Format Graph dialog. For each data set, choose whether it should be interleaved with, stacked on top of, placed apart from the (starting a new group of bars, hence the name “grouped”) or superimposed on the preceding data set.

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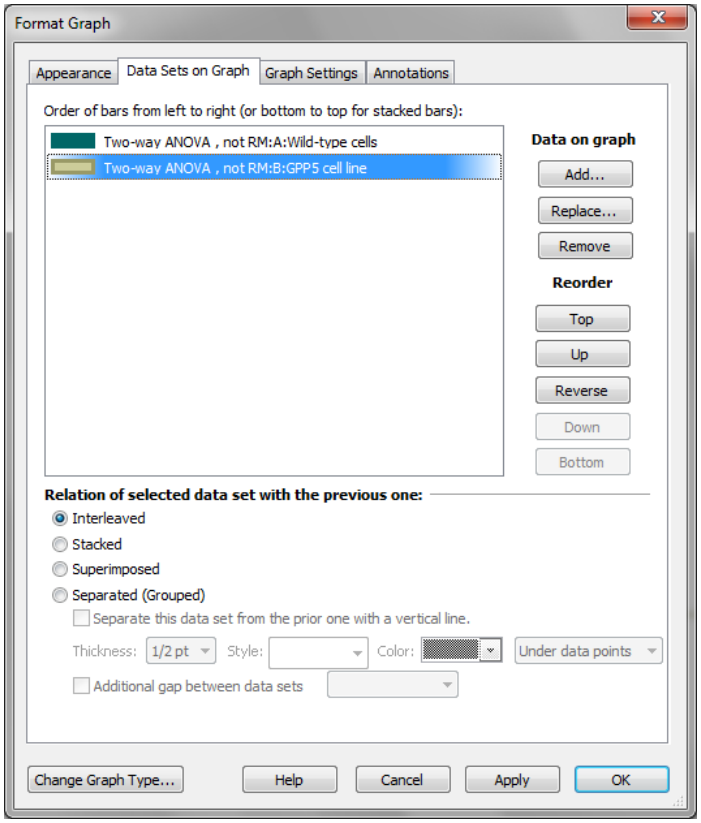
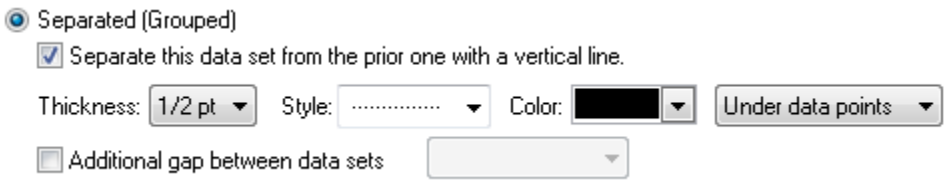


Add lines between groups

Check the box to Separate a data set from another with a line.



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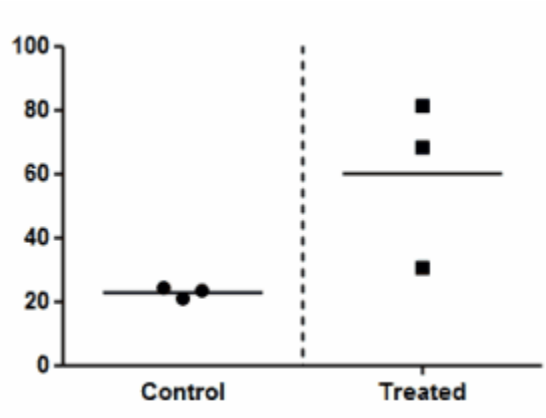
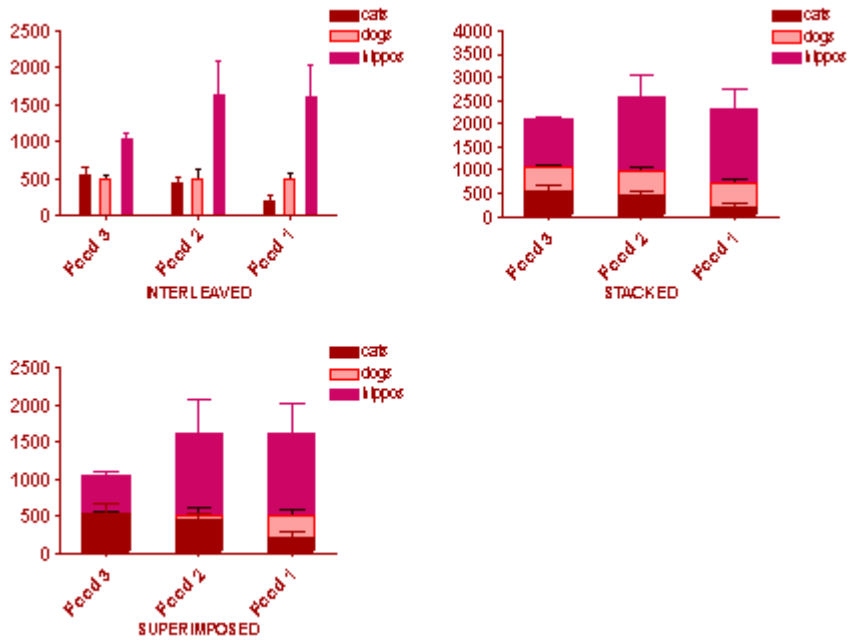


Stacked and superimposed bars

Note the difference between Stacked and Superimposed below. When the bars are superimposed, each extends from the X axis to the value. When bars are stacked, each bar starts at the top of the one below.



Notes:

- If bars are superimposed, it can help to use semitransparent colors. That way you can see the smaller bar that is hidden behind a taller one.

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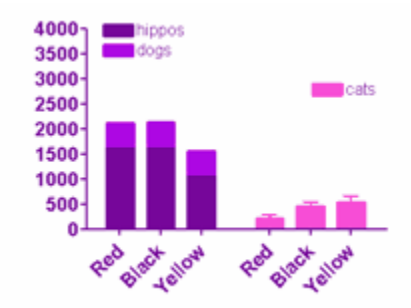
- Use the second tab of Format Graph to change the order of data sets, which controls which data set is on top.

- With stacked bars, each row in the data table becomes one stack of bars. If you want to leave a gap between stacks (to create a natural grouping of sets of stacked bars), leave a blank row in your data table.

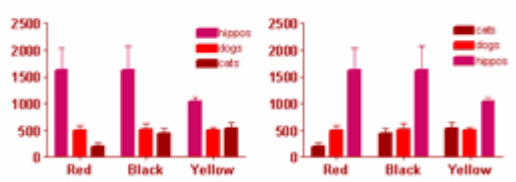
- It sometimes is helpful to combine both stacked and interleaved bars on the same graph as below. This is done by checking the option to stack the "dogs" data set on top of hippos, and to make the "cats" data set grouped.



14.4.5.3 Plotting order of Contingency graphs

Data set order

The two graphs in this example are identical except that the plotting order was reversed.



Click the Rotate/Flip button in the Change section of the Prism toolbar to reverse the order of data sets on a graph.

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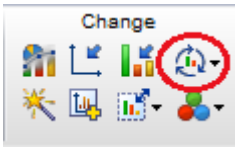
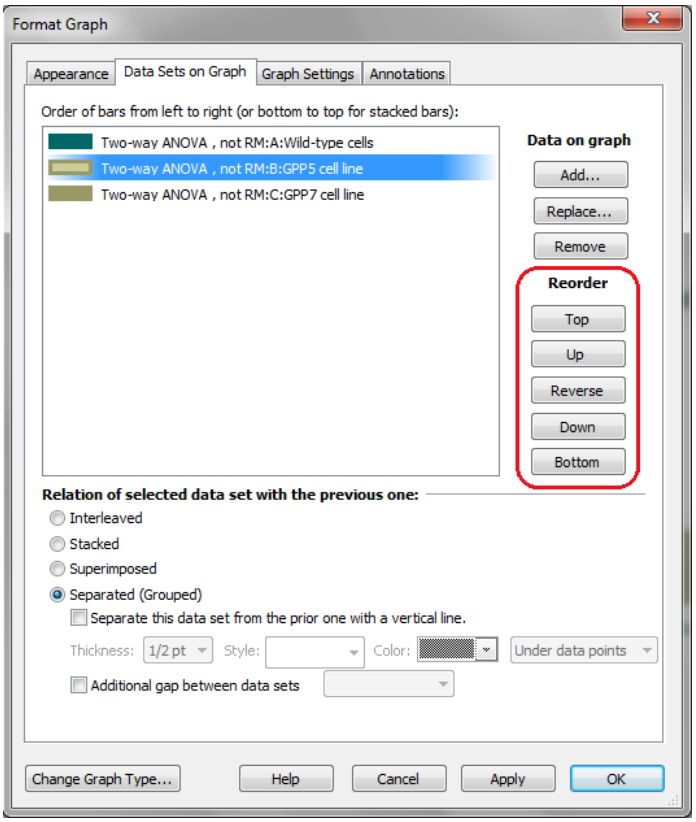
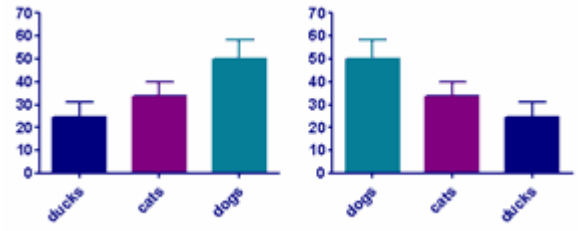


To fine tune the left-to-right order, go to the Data Sets on Graph tab of the Format Graph dialog.



The two graphs in this example are identical except that the plotting order was reversed.



To reverse the plotting order of the data sets on a graph, click the Rotate/Flip butto

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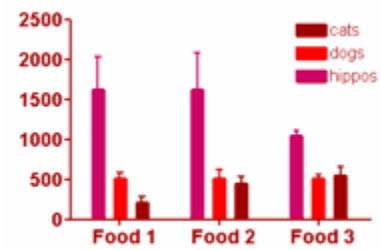
Changing the order of the data sets on this dialog changes the font-to-back (if you plot symbols) or left-to-right (if you plot bars) order of the data sets on the graph. It does not change the order of the legends 356.

Order of bars within a data set

The previous section explained how to adjust the order of the data sets. The order of the individual columns within a particular data set is determined by the order they are entered in the data table.

Table format: Two-way		A					B		
		cats					dogs		
		A:Y1	A:Y2	A:Y3	A:Y4	A:Y5	B:Y1	B:Y2	B:Y3
1	Food 1	44	55	233	455	235	643	456	744
2	Food 2	435	346	456	264	750	333	345	653
3	Food 3	329	256	556	678	890	556	543	337



To reverse the row order on a data table, go to the data table. From the Change menu, click the Sort button, and choose "Reverse row order".

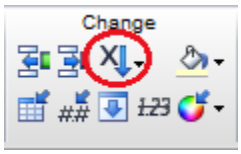


Table format: Two-way		A					
		cats					
		A:Y1	A:Y2	A:Y3	A:Y4	A:Y5	B:Y
1	Food 3	329	256	556	678	890	
2	Food 2	435	346	456	264	750	
3	Food 1	44	55	233	455	235	

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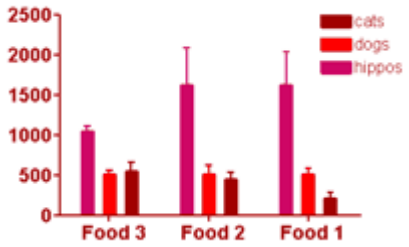
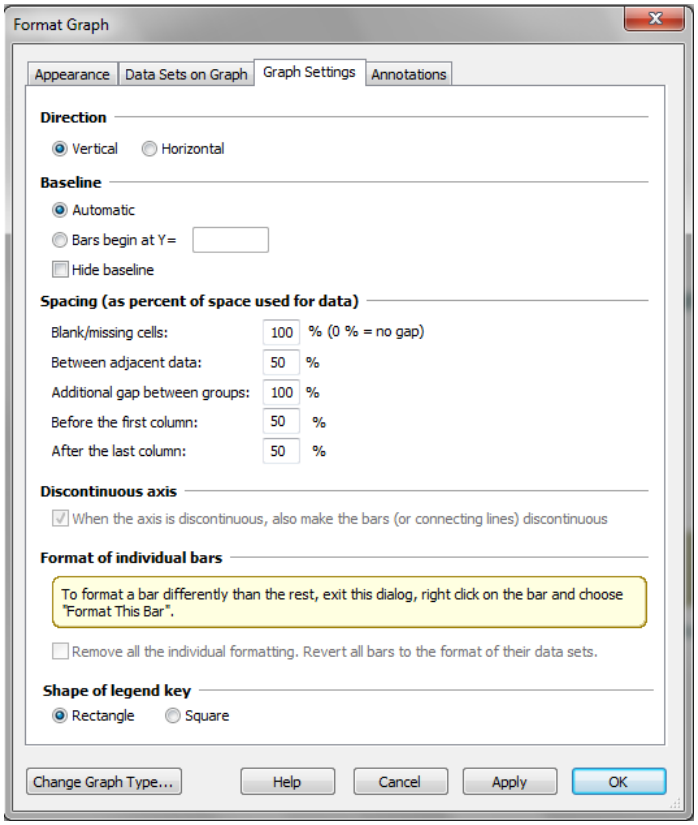


See another example of changing plotting order for Grouped graphs. 249

14.4.5.4 Additional Grouped graph settings

Graph Settings tab of Format Graph dialog

Use the Graph Settings tab of the Format Graph dialog to change the direction of bars on a graph from vertical to horizontal, to set the baseline for bars (but they really should start at zero), and to adjust the space between columns. Double-click on any bar to open the dialog.



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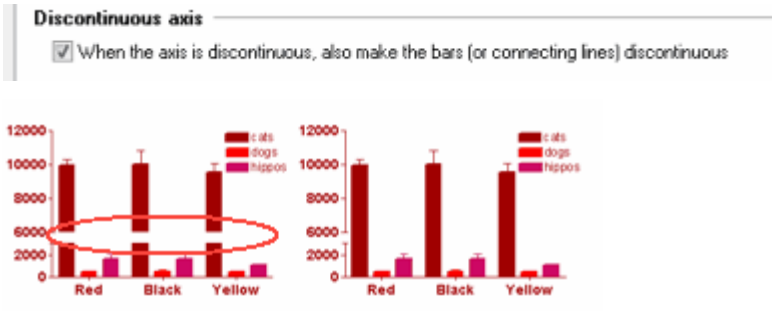
Spacing

This is explained in a separate help page 463.

Discontinuous axis

When you have a gap in a Y axis, choose whether or not you also want a gap in any columns that span the gap. Not leaving a gap may make your graph misleading.



Shape of the legend key

For bar graphs, choose between square or rectangular (wider) boxes before the legend text.

14.4.5.5 Row or column titles under bars?

You can change how the bars are labeled. Double-click on the axis to bring up Format Axis, then choose to use Row numbers, Row titles, or Column titles.

14.4.6 Heat maps

.

14.4.6.1 Creating a heat map

Heat maps are a standard way to plot grouped data. The basic idea of a heat map is that the graph is divided into rectangles or squares, each representing one cell on the data table, one row and one data set. The

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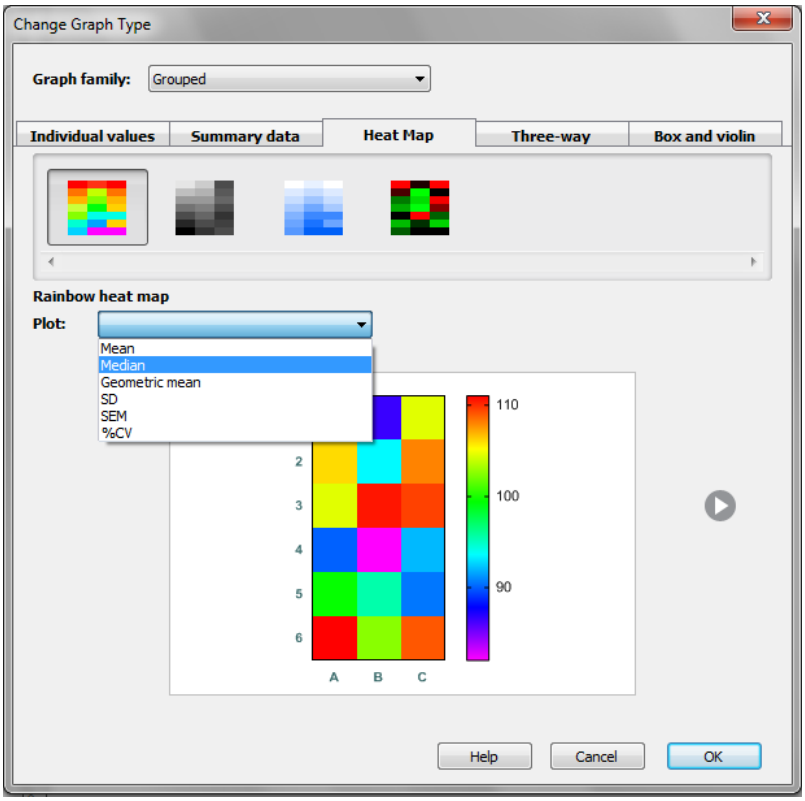
rectangle or square is color coded according to the value of that cell in the table. Prism offers lots of options to make Heat maps useful.

Enter data on a Grouped table. Most often you'll want to format this with no subcolumns. In this case, each number you enter maps to one rectangle on the heat map. Unless you choose to reverse or transpose axes, the arrangement of the colors on the heat map will correspond to the numbers in the table. If your table as three rows and four columns, the heat map will also have three rows and four columns.

If you enter replicate values in side by side subcolumns, you can later choose if you want the heat map to be based on the mean, median or geometric mean of the replicates. You can even choose to make a heat make of variation, and use the SD, %CV or SEM as the basis of the heatmap.

When you go to the automatic graph (or choose New..Graph of existing data), the New Graph dialog opens. Choose the Heat Map tab and make basic choices about the kind of heat map you wish to make.



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Once you see the graph, double click on it to bring up the Format Graph dialog with many more choices.

Color mapping 473

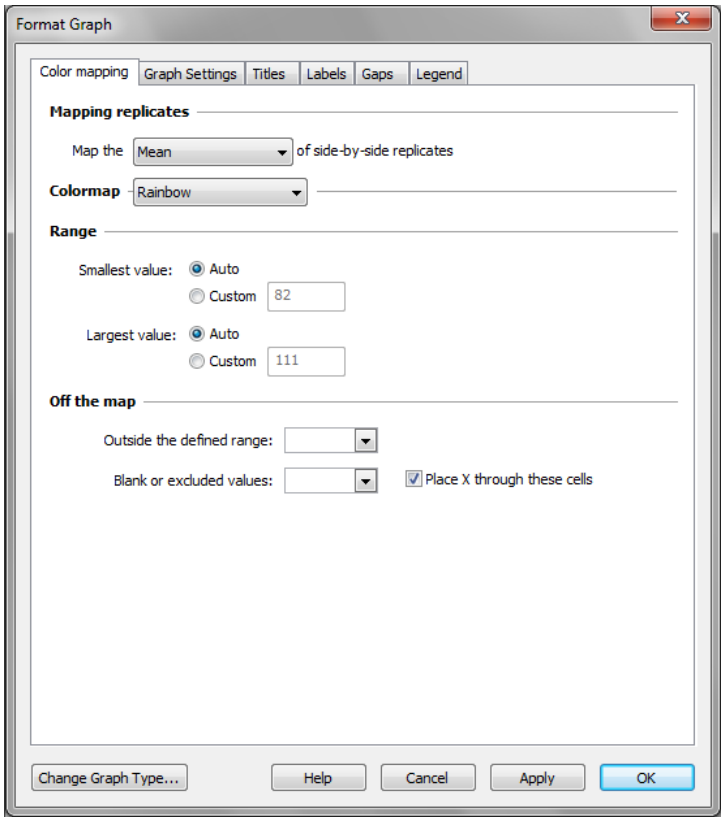
Graph settings 475

Titles and labels 476

Gaps 478

Legends 479

14.4.6.2 Color mapping



Mapping replicates

If you entered replicate values (side by side), you can later choose if you want the heat map to be based on the mean, median or geometric mean. You can even choose to make a heat make of variation, and base the heat map on the SD, %CV or SEM of replicate values.

Color map and range

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There are four choices of color maps:

- Single gradient. Choose the range of values to convert to colors and the range of colors.

- Grayscale. You can choose whether black or white is for the lower value, and what the range of values is.

- Rainbow. You choose the range of data values. Prism chooses the range of colors by fixing the saturation and brightness to 100% and varying the hue from 0° to 300°. Using the Rainbow color map, the largest values are shown in red. If you select the Reverse Rainbow color map, the smallest values are encoded red.

- Double gradient. You choose the baseline value (almost always 0.0) and color (usually white or black). Then separately enter the maximum value (almost always positive) and color, and also enter the minimum value (almost always negative) and color.

- Categorical. Enter a value or range of values, and what color you want it to show as. Repeat as needed. Ranges cannot overlap. You can't have one range "1-2" and another "2-3" because that would leave it ambiguous how to encode 2.0000. Instead do something like this -- one rage for "1.0-1.99" and another for "2.0-2.99".

Off the map

Choose a color to use if the value is too large or too small to be part of the map you defined, or if the value is blank or excluded. Of course, these choices are irrelevant if no values are off scale, blank or excluded. To make blank and excluded values more apparent, check an option to place a black X through those cells. Since the X is always black, use a light color to encode these cells.

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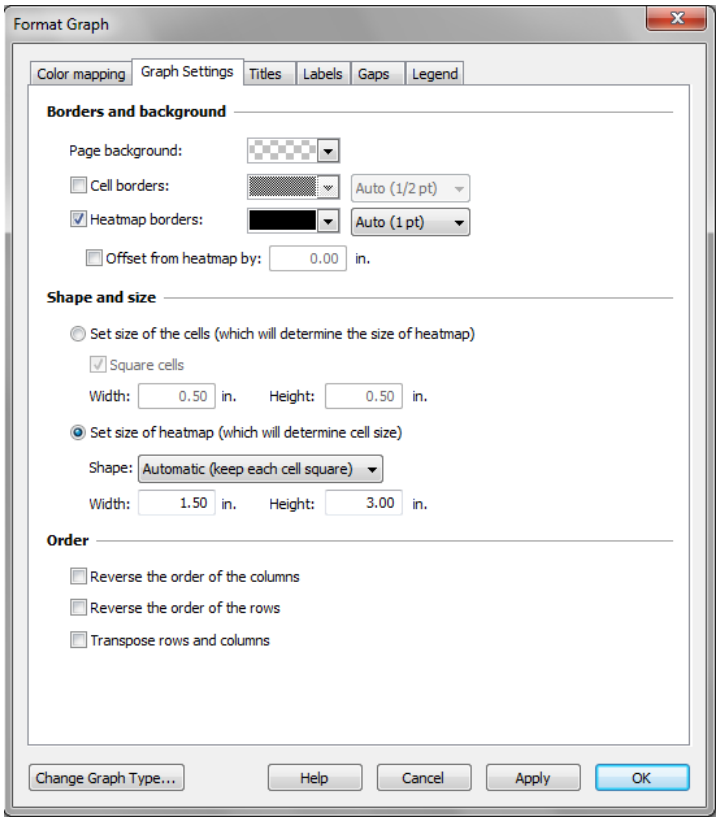
14.4.6.3 Graph settings



Borders and background

Choose the page background color and the color and thickness of the borders around each cell (box) and around the entire heat map.

Size and shape

You can set the size of the entire heat map, in which case the size and shape of each cell will be determined by that size and how many rows and columns there are. Or set the size and shape of each cell, and the overall size is determined from that.

Order

Optionally reverse the order of columns and/or rows. Or transpose rows and columns.

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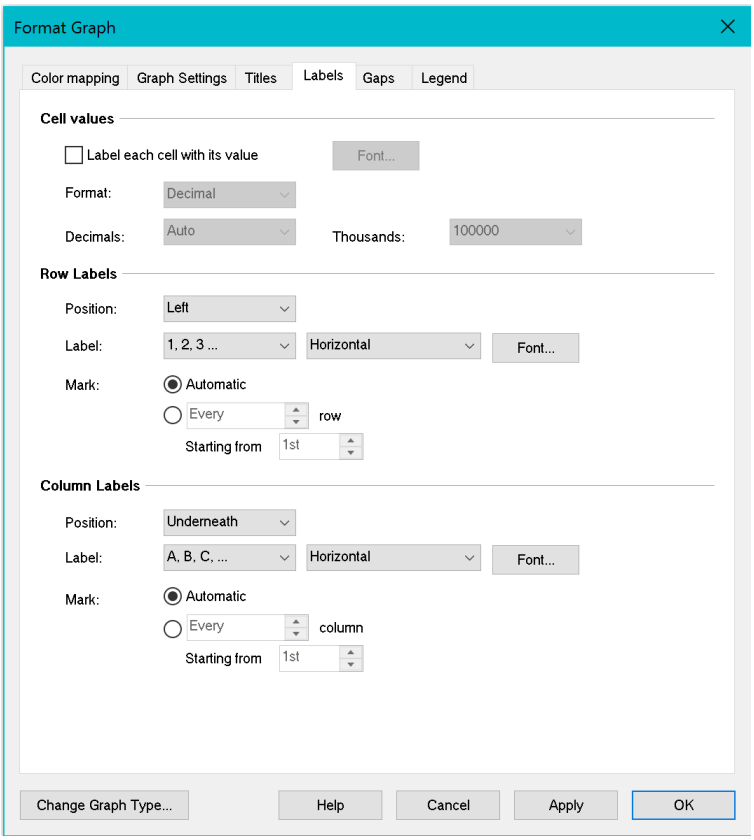
14.4.6.4 Labels



Choose whether to write the numerical value (or the mean, median, etc) of each cell in that cell, and how to label the two axes.

14.4.6.5 Titles

Choose whether to show an overall title, or titles on the two axes, and choose their fonts.

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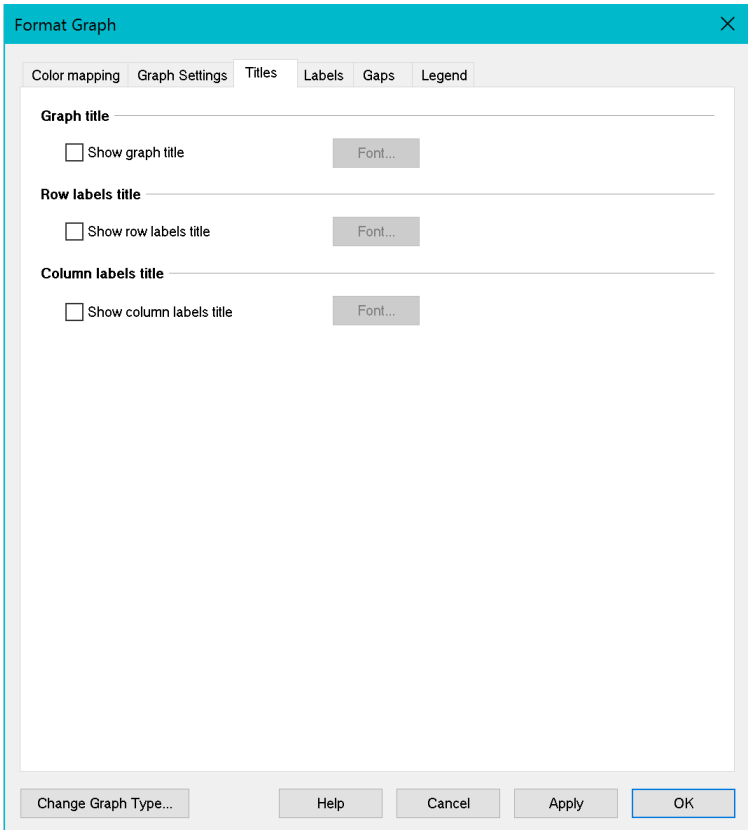

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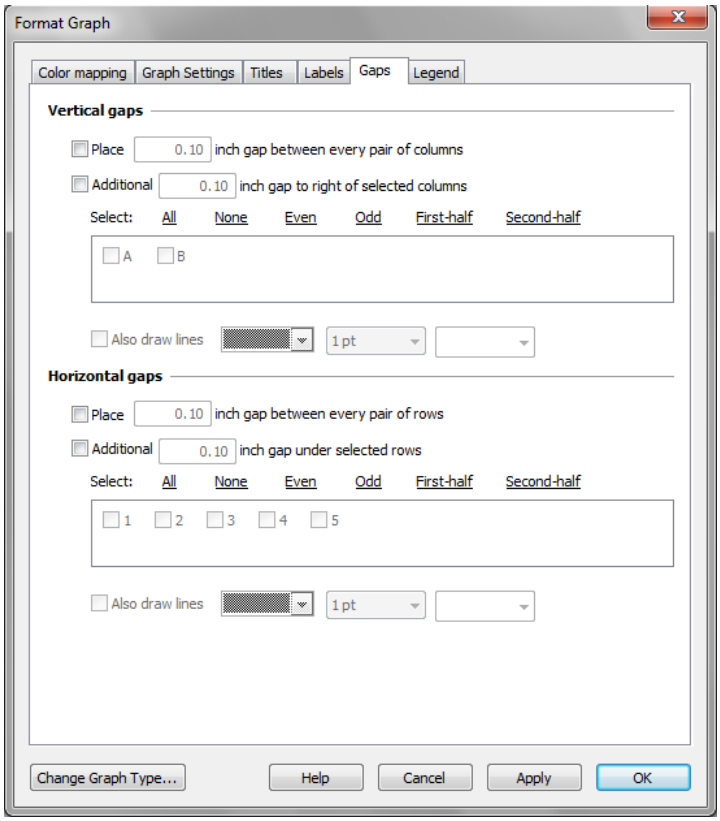
14.4.6.6 Gaps



There are two reasons to use gaps.

- You can put gaps next to and under all the cells just because you think the heat map is more attractive that way. The gaps server as borders.
- Use gaps to group sets of rows and columns to give some structure to the heatmap. Maybe the left half is for one cell line, and the right half for another. Put a gap in between to distinguish them.

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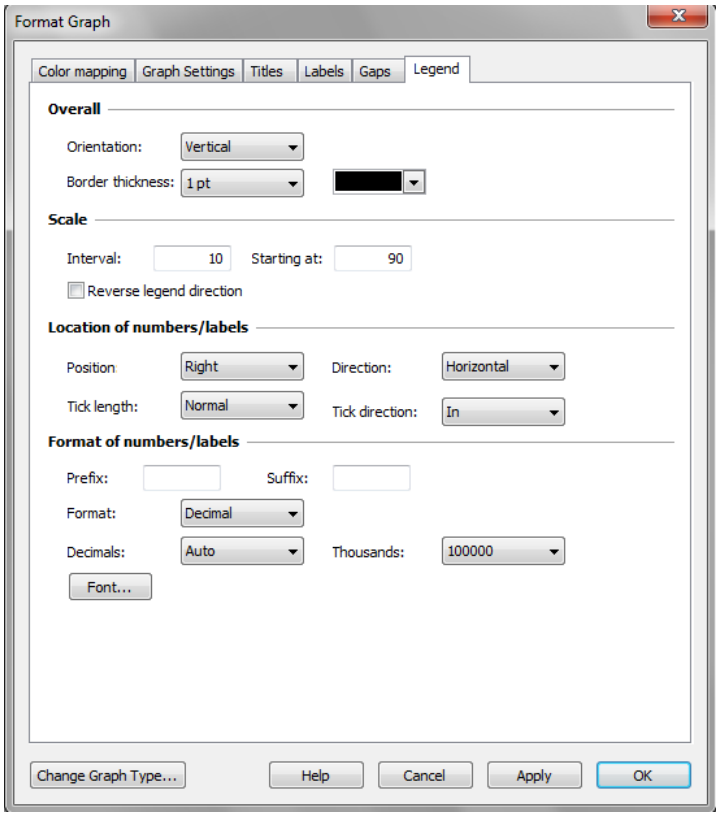
14.4.6.7 Legend for heat maps



The legend is the key that maps colors to value.

Choose if the legend will be horizontal or vertical and whether it has a border, then choose the interval for labeling it, and the location and formatting of each label.

14.4.7 Survival graphs

Format graph: Survival

Prism lets you change every feature of a graph. Change the shape, color, and size of graph symbols; change the fill pattern and color of graph columns; change the order that data sets are plotted.

Double-click on any symbol or bar (or the background of the graph) to bring up the Format Graph dialog.

See also:

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Appearance of Survival graphs 480
Changing the plotting order of data sets 483
Nudging survival data sets 485
Error bars and confidence bands on Survival graphs 376

14.4.7.1 Appearance of Survival graphs

Format Graph dialog - survival plots

Use this dialog to change the look of all the points in a data set. If you want to change the look of a single data point 351, use the right-click menu. You can also change all the symbols in selected data sets 351.

Double-click on any graph symbol or bar to open the Format Graph dialog.

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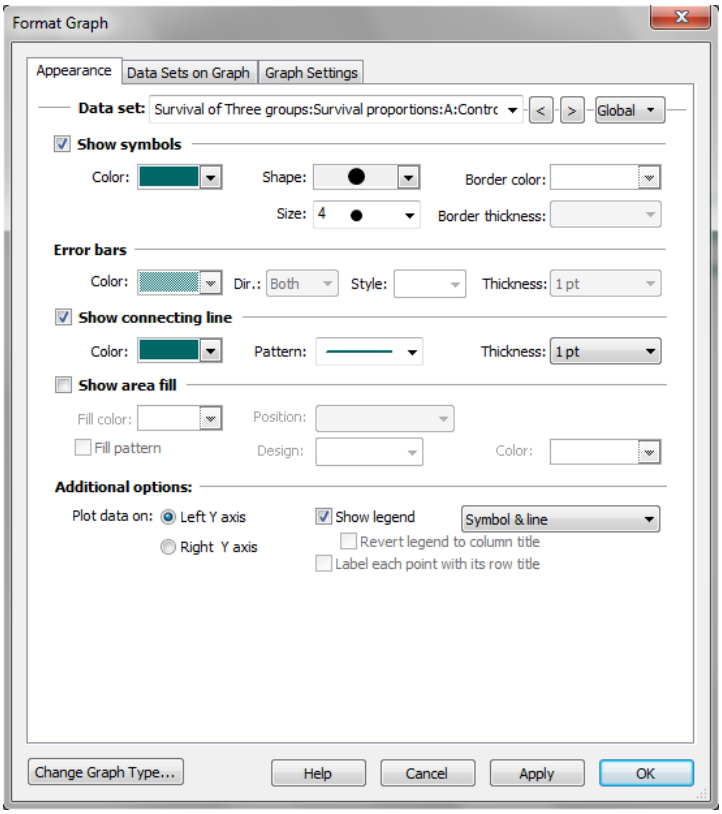

To change the settings for one data set:

Select a data set from the list, and choose the symbols, lines, and error bars for that data set. Then select another data set and choose settings for that data set. Click OK to redraw the graph with all the changes. Note that a fitted curve is treated as a separate data set.

To change all data sets on the graph (for example to make all symbols larger):

Drop the list of data set names and choose --Change ALL data sets--. Or click the ALL button just to the right. Changes you make after that will then apply to all data sets.

Show Symbols

Choose symbol type, size, and color. If you pick an open symbol, also select a border thickness. Check the Clear option if you want point-to-point lines and overlapping points to show through the open symbol. Use Shape the drop-down menu to select one of Prism's symbols. Use the More option on this drop-down to use any character from any font on your computer as a symbol.

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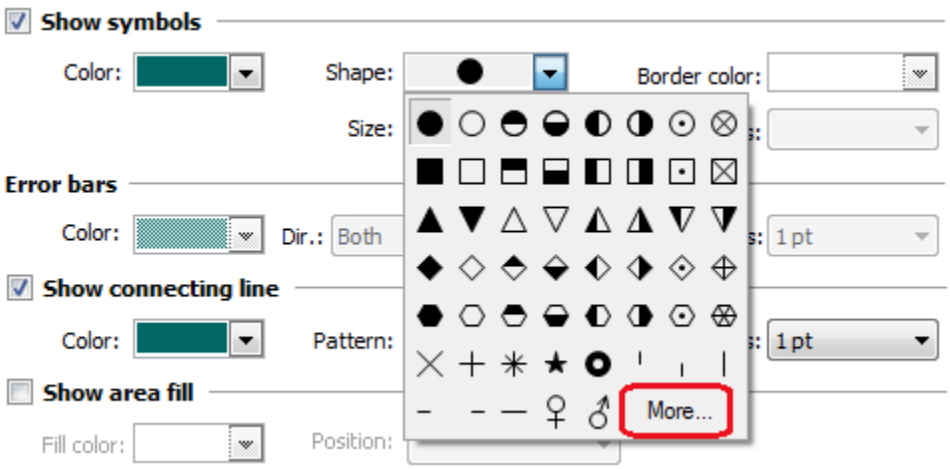
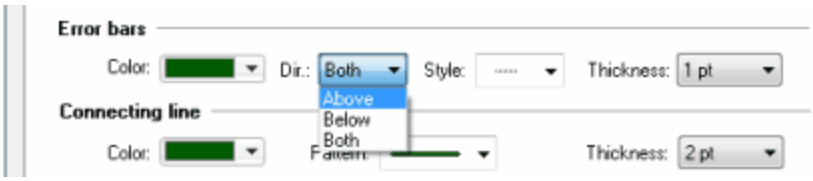


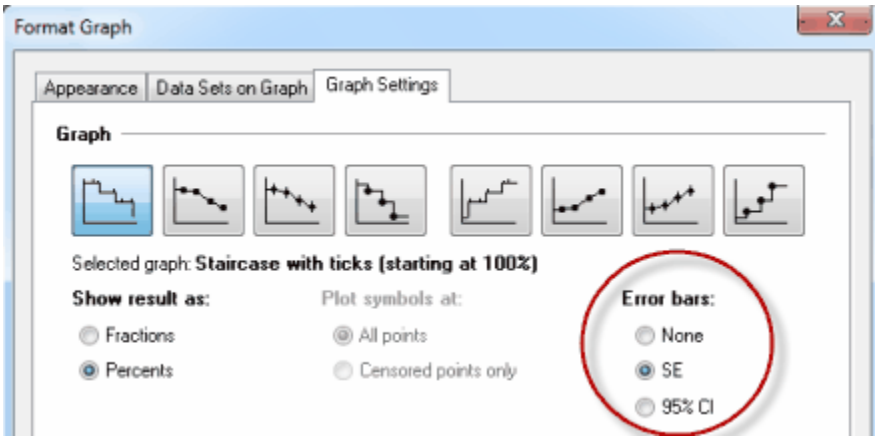
In survival plots, you can choose to show symbols only for censored data points, or for all data points. Make this selection on the Graph Settings tab of the Format graph dialog.

Error bars

Choose how you want error bars to be formatted. Error bars can go above or below a data point or in both directions. Learn more about error bars on survival graphs 376.



Depending on the choices you made when you created a survival plot, the option for error bars may or may not be available. You can change this setting in the Graph Settings tab of the Format Graph dialog.



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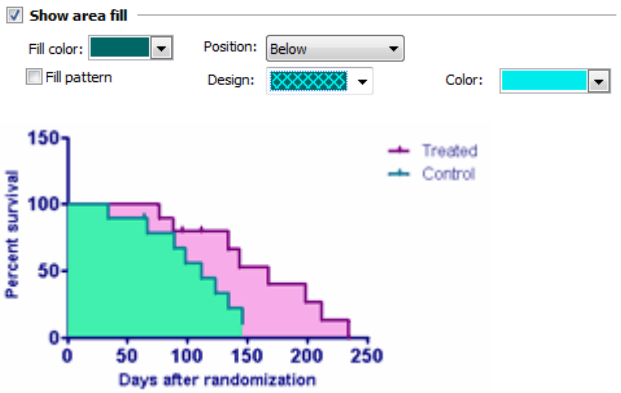
Connecting lines

Choose the format of lines connecting data points for a survival plot. Consider using arrows.

Show Area fill

Choose to show area fills below or above the plot lines. Click the All button to turn on this feature for all the data sets on a graph.



Plot on which Y axis

Specify which axis to use for each data set. If you choose to plot on the right Y-axis, Prism will create that axis if it doesn't already exist.

Legend

See the page on Legends for XY graphs. 356

14.4.7.2 Changing the plotting order of data sets

Change the order to determine plot lines are in front. Plotting area matters the most when you use area fills. The graphs below are the same, but with the plotting order reversed. Note that on the graph on the left the area fill from the one data set hides the other.

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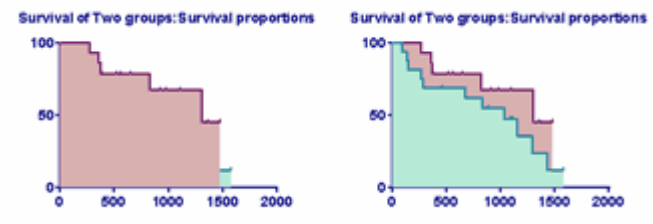
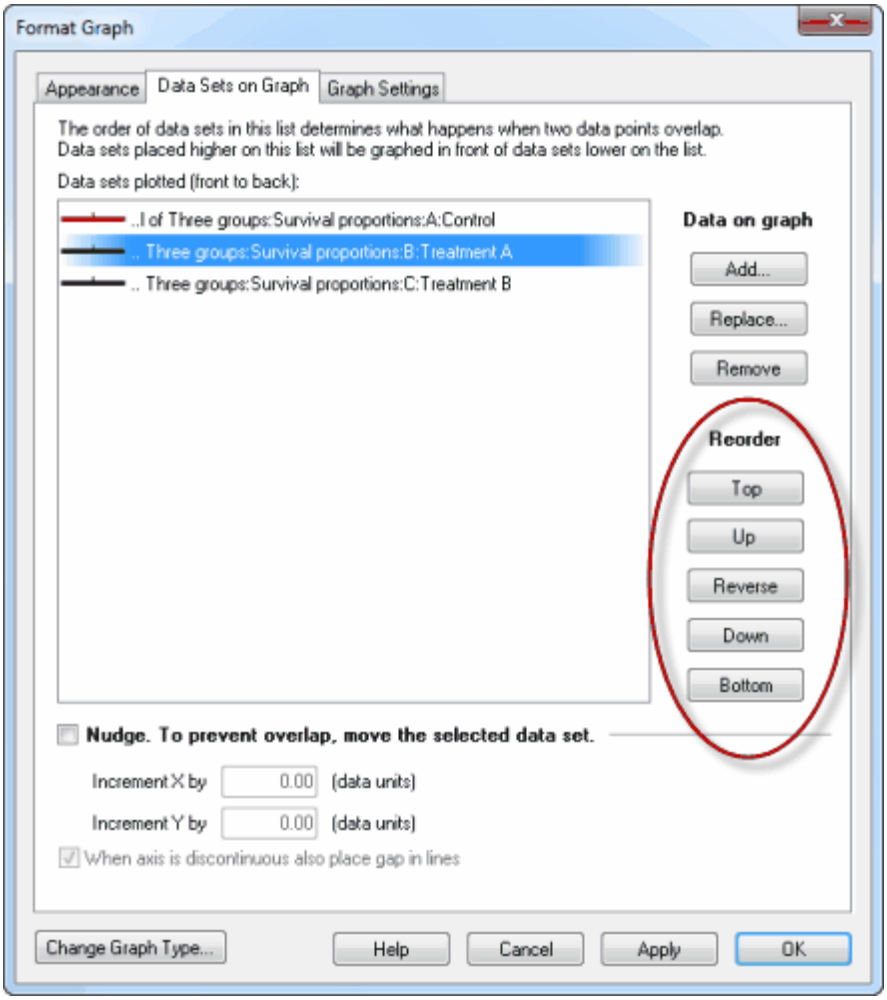


To change the plotting order of the data sets on a graph:

Click the Rotate/Flip button in the Change section of the Prism toolbar to reverse the front-to-back order of data sets on a graph.

To fine tune the front-to-back order, go to the Data Sets on Graph tab of the Format Graph dialog.



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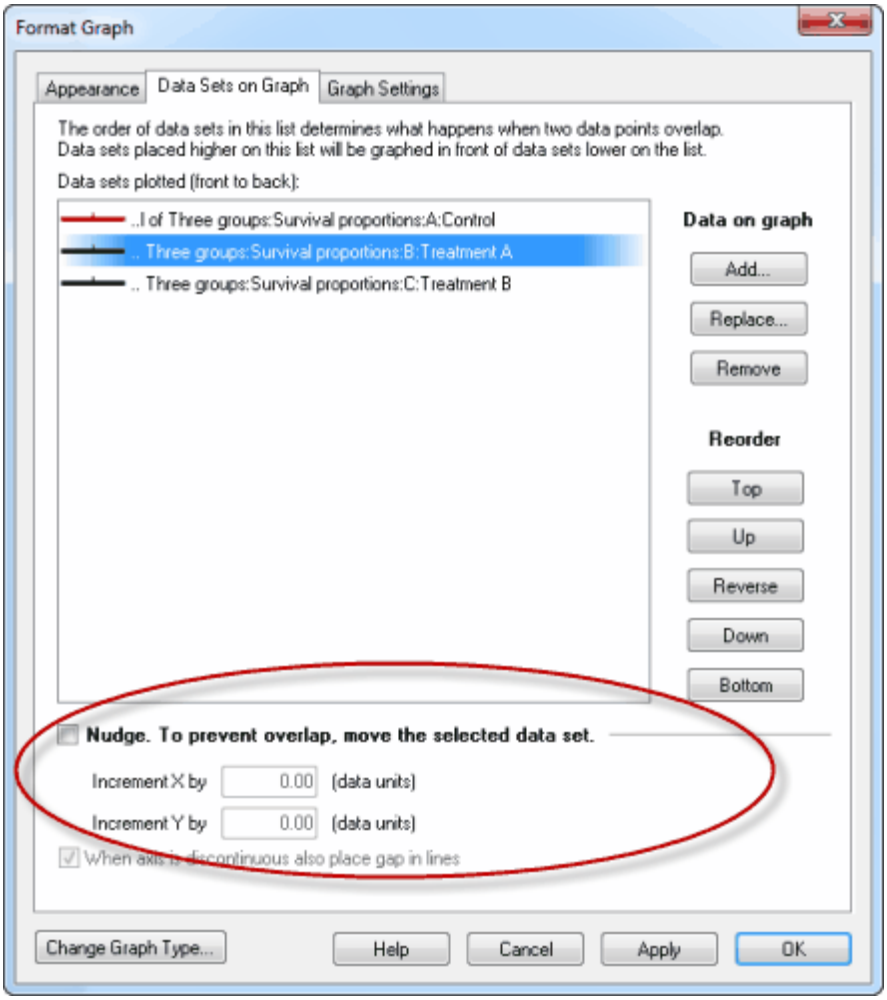
14.4.7.3 Nudging survival data sets

Nudging can be helpful to differentiate datasets that otherwise overlap a lot. The "Treatment B" data set in the graph on the right has been nudged up a bit to separate it from the "Treatment A" data set.



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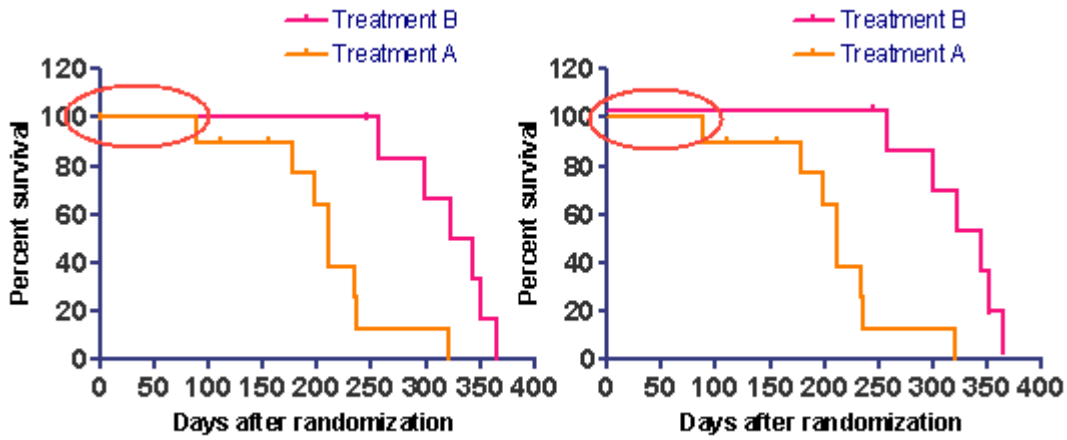

14.4.8 Parts of whole graphs

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14.4.8.1 Changing the look of parts of whole graphs

Format Graph dialog - Parts of whole plots

Use this dialog to change the look of a Parts of whole graph If you want to only change the look of a single segment, it is simpler to use the right-click menu on the graph. You can also change all the symbols in selected data sets 351.

Double-click on any graph section to open the Format Graph dialog.

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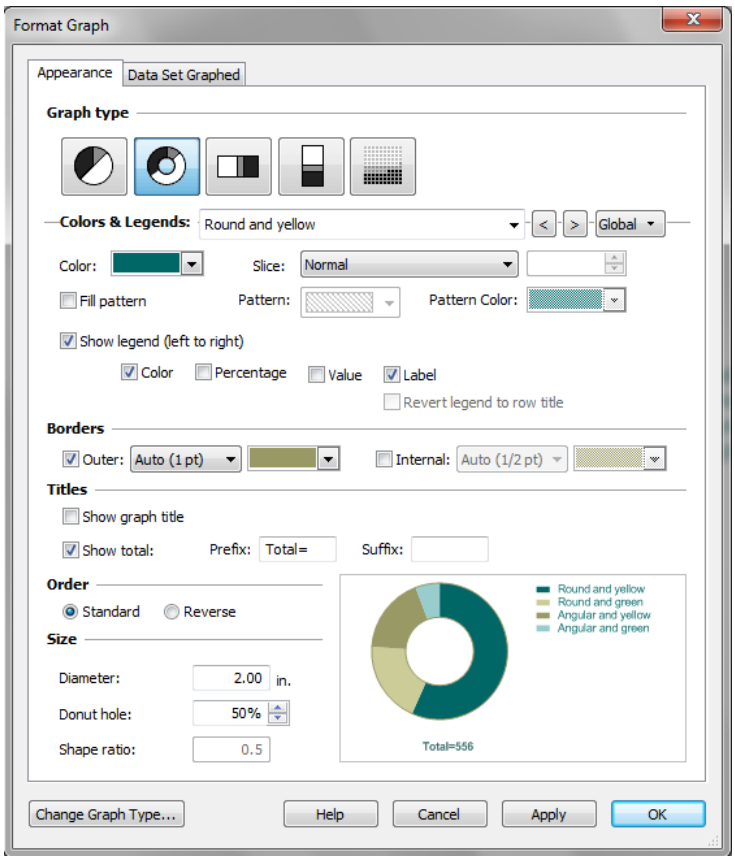

To change the general appearance of the graph:

Click on the thumbnail image in the Graph type section of the dialog. You can change from a pie chart to a donut, slice or dot plot. Prism will preview how your graph will look after the change.

To change the settings for one data set:

Select a data set from the Colors and legend list, and choose the color or fill pattern of the graph segment, and what information you want the legend to show.

To change all data sets on the graph:

Click the Global button to select all data sets on the graph. Or, select the data sets from the drop-down menu that you want to change.

If your graph only has one data set (one slice):

The graph is generated from values entered into a single column in the data table. If you enter data into a row, you'll only get one value on the graph.

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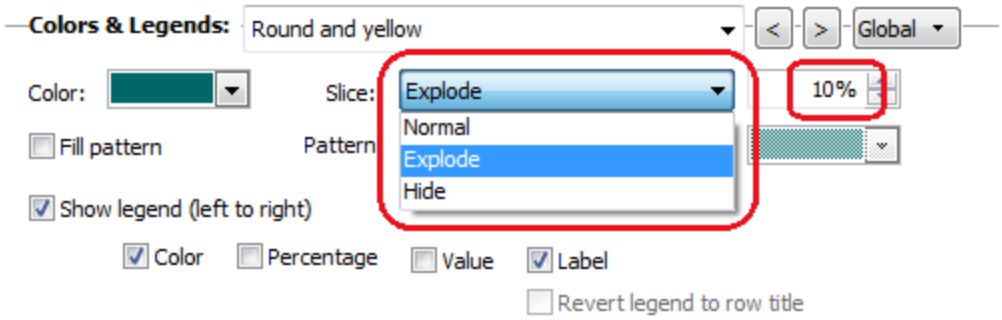
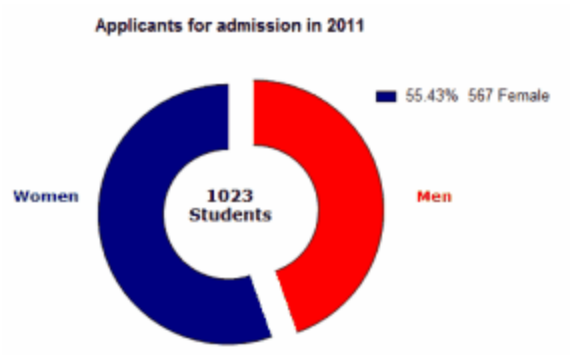
Color and Legends

You can set the color of each graph segment. Use the roll-down to choose if you want a particular segment of a pie or donut graph exploded from the main graph and how far away you want it to be. Or choose to hide a segment.





Choose the information you want the legend to show and how you want it formatted.

If one of the rows of data is zero, then Prism will not create a legend for it. If you want a legend, even though the value is zero, enter some tiny nonzero value like 0.000001. The slice will be invisible on the graph, but Prism will create a legend for it.

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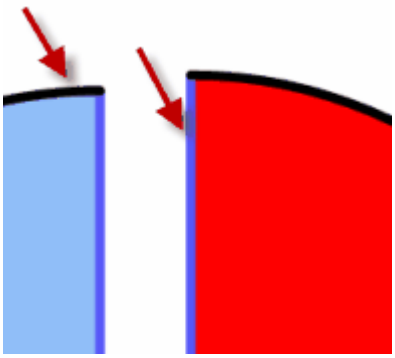
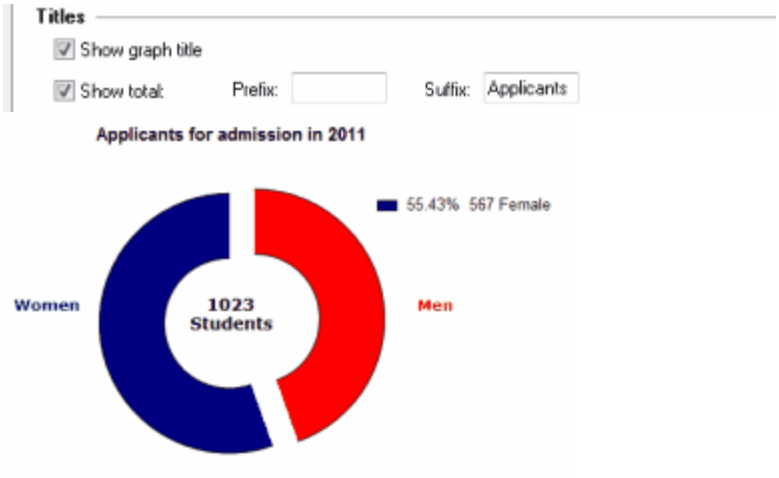
Borders

Choose the color and thickness of the segment borders. You can have different settings for the inner and outer borders. These setting are for all the segments of the graph.



Titles

Click to show or hide the graph title, or to show or hide the total of all values, The graph shows each category as the fraction of the total, so it can be very useful to show the total near the graph. With donut graphs, it is common to put the total in the center of the graph as shown below. Optionally add a prefix or suffix, for example: 1,000 Applicants, or Total: 1,000.



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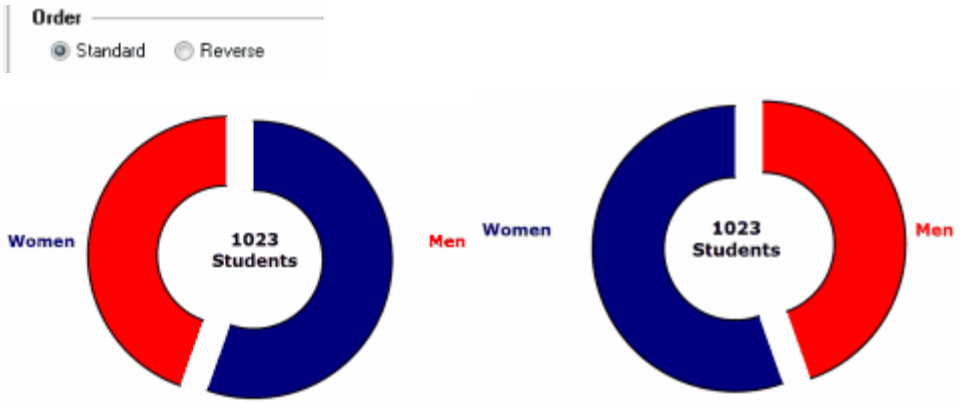
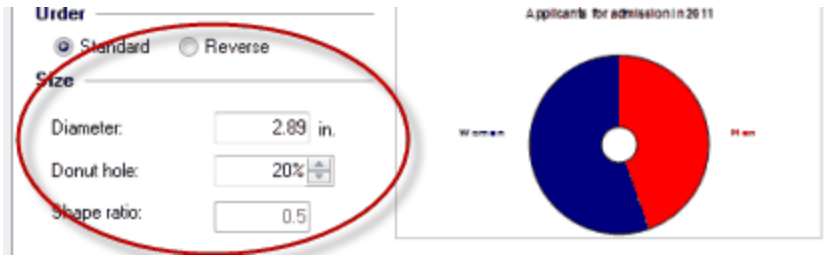
Order

Reverse the order of the data sets to change the orientation of the graph.



Size

Use the Size portion of the dialog to change the size of the whole of a donut graph.



14.4.8.2 Changing which data set is plotted

A parts-of-whole graph can only plot one data set. To plot a different data set, double click on the graph to bring up the Format Graph dialog, go to the second tab, and choose the table and data set to plot.

Note that the values that comprise a parts-of-whole graph are always entered into one data set column. If your values are in a row, you'll need to select them, copy to the clipboard, go to an empty row and paste.

14.4.9 Nested graphs

Enter topic text here.

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14.4.9.1 Appearance tab: Nested graphs

For the most part, the choices are the same as for Grouped graphs 439.

For each data set, decide if the subcolumns should be shown as scatterplotm aligned scatter plot, before-after (used rarely for nested data), symbol at mean, bar, box-whisker or violin plots. Use the "global" setting to change all data sets at once.

At the bottom of the dialog, choose which Y axis the data set is plotted on and whether to show a legend or not.

14.4.9.2 Data sets on graph tab: Nested data

For the most part, the choices are the same as for Grouped graphs 449.

At the top of the tab, choose which data sets are included on the graph.

At the bottom of the tab, choose how the data sets are related to each other. Usually you will want interleaved or separated. Superimposed rarely is helpful. If you separate the data sets, optionally choose to place a line and/or gap to separate one data set from the next.

14.5 Format Axes dialog

Scientists often individualize the axis range, numbering and ticks.

Axis range 493

Axis numbering 494

Major and minor ticks 497

Graphs with two Y-axes 358

Hide an axis and show scale bars 498

Put a gap in an axis 500

Additional ticks and grids 503

Axis titles 509

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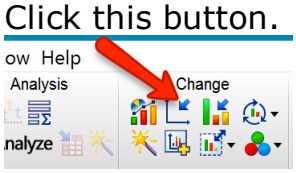
14.5.1 Overview of the Format Axes dialog

How to bring up the Format Axes dialog?

Two ways:

- Double-click on an axis.
- Click this button.



Uses of the Format Axes dialog

The first tab lets you makes changes to the frame and origin 535, and to choose a color for the page background and the plotting area.

The middle tabs let you format the X axis, the left Y axis and the right Y axis 493.

The last tab lets you turn axis (or graph) titles 509 on or off, and choose their font and distance from the graph.

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How to change the color or thickness of one axis

In rare cases, you may want to change the color or thickness of one axis and not the other(s). Or you may want to make one axis white (or whatever your page background color is) to make it essentially invisible. To do this, select the axis, drop the Change menu and choose Selected Object. Then change the color or thickness in the Format Object dialog.

14.5.2 Axis range, numbering & titles

Axis range 493
Axis numbering or titles 494
Major and minor ticks 497
Hide an axis and show scale bars 498
Discontinuous axes 500
Additional ticks and grids 503
Axis titles 509

14.5.2.1 Axis range

Double-click on an axis to open the Format Axes dialog. Or click on the Format Axis tool in the Prism toolbar.

Prism chooses the range of each axis automatically. To override this, uncheck the "Automatically determine the range and interval" box and enter the minimum and maximum value you want plotted on the axis. You can also hook 306 a range limit to an info constant.

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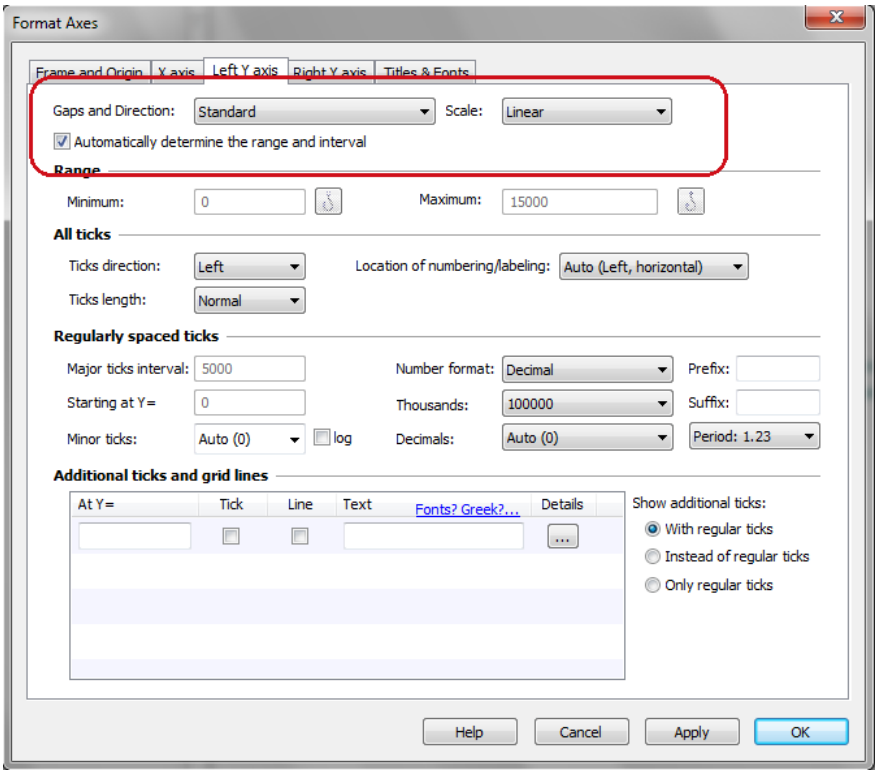
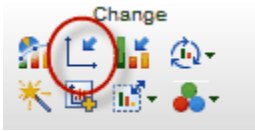


You can only set the range on numerical axes, not the categorical axis of Column and Grouped graphs.

14.5.2.2 Axis numbering or titles

Double-click on an axis to open the Frame and Origin tab of the Format Axes dialog. Or click on the Format Axis tool in the Prism toolbar.



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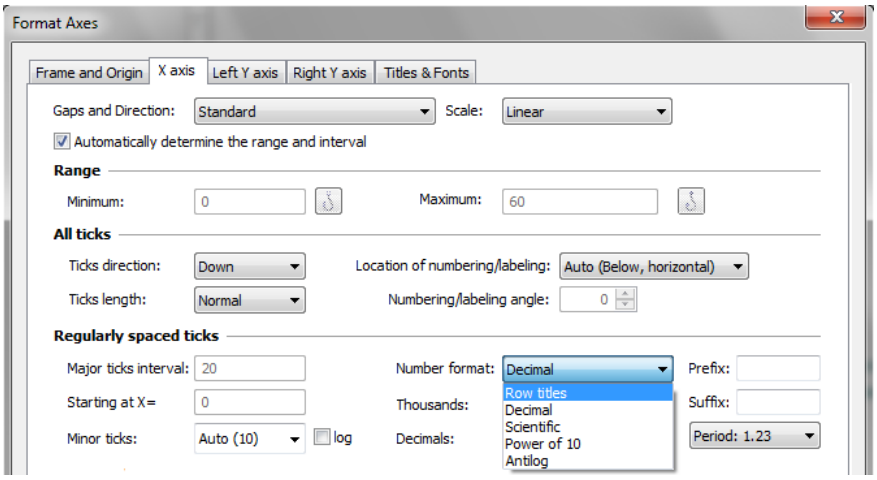
What values or labels show on the X axis?

XY graphs

Normally, of course, the X axis of an XY graph plots the X values you enter into the X column. The X axis, in this case, is numerical. If the X values are not evenly spaced, then the points won't be equally spaced.

If you enter row titles for each row, then you can choose to label the X axis with row titles rather than X values. Choose in the Number format drop down in the Regularly spaced ticks part of the Format Axes dialog.



When you choose to label the X axis with row titles, the spacing of the points may change. Essentially, Prism uses the row number as the X value, so the points will be equally spaced along the X axis, even if the X values are not evenly spaced. By default, each row label will appear. If you have many rows, this will be cluttered. You can ask Prism to plot, say, every fifth row label by changing the major tick interval to 5, starting at 0. Keep in mind that Prism uses the row number (first row is 1) rather than the values entered into the X column, to position the data and determine which labels to show. Prism also uses this coordinate system (row numbers) when positioning additional ticks and grid lines. If you ask for a grid line at X=5, Prism will draw it to correspond with the point in the fifth row, whatever its X value.

If you entered elapsed times or dates instead of X values, Prism presents a different set of choices for Number format.

Grouped and contingency table graphs

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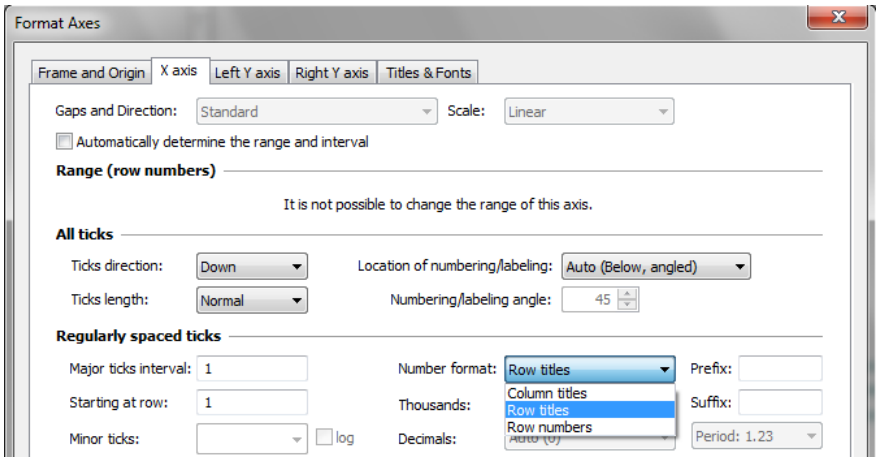
With Grouped graphs (and graphs of contingency tables), you can have a choice of labeling the X axis with row titles, column titles, or row number. You may or may not see all three choices, depending on how you configured your graph.



Other types of graphs

Survival graphs always use survival time as the X values. Column graphs always label the X axis with column titles. Parts-of-whole graphs don't have axes.

Appearance of axis numbers or labels

To change the font, size, and color of the numbering for one axis:

Go to the Titles and Fonts tab of the Format Axes dialog. Click the Font button in the Numbering or labeling section. Or select an axis by clicking on it, and use the Font settings in the toolbar.

To change the default font used for new graphs:

Set on the New Graphs tab of the Preferences dialog 191.

To move the numbers above/below the X-axis or to the right/left of the Y-axis:

Select the position of the axis numbering in the Axis Titles section on the Titles and Fonts tab of the Format Axes dialog. Or select the axis numbering by clicking once; then drag the numbering with the mouse or nudge it by clicking the arrow keys:

To put a prefix in front of all axis numbers, or a suffix after:

Enter the prefix (i. e. "$") or suffix (i. e. "%") in the Format Axes dialog.

To rotate the numbering 90 degrees:

Set the number orientation In the All Ticks section in the Format Axes dialog.

To label axes with row titles instead of X values:

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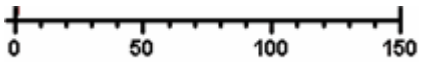
If you entered both X values and row titles on an XY data table, you can choose to label the axes with Row Titles instead of Decimal numbers via the Format setting in the Regularly spaced ticks section of the Format Axis dialog. If you do this, Prism will ignore the X values entirely, and use the row number (top row is 1) as the X values when plotting values.

14.5.2.3 Major and minor ticks

Prism lets you show both major and minor ticks on an axis. By default, Prism automatically sets the minimum and maximum range for an axis as well as the major tick interval.



To change the major or tick interval:

Double click on an axis to open the Format Axes dialog. Uncheck the Auto box in the Range section and set the major tick interval in the Regularly Spaced Ticks section.

To show minor ticks:

Double-click on an axis to open the Format Axes dialog. Select an interval for minor ticks in the Regularly Spaced Ticks section. Choose the interval for minor ticks between major ticks and whether you want regular or log spacing 518. Select the number of intervals you want between major ticks, not the number of ticks. (For example, choosing four intervals creates three minor ticks.)

To hide ticks:

Double-click on an axis to open the Format Axes dialog. In the All Ticks section, choose None for Direction in the All Ticks section.

To change the direction and length of ticks:

Double-click on an axis to open the Format Axes dialog. Set the direction and length of ticks in the All Ticks section.

To place additional custom ticks or grid lines on a graph:

See: Additional ticks and grid lines 503.

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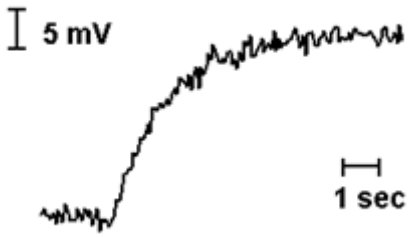
14.5.2.4 Hide an axis and show scale bars

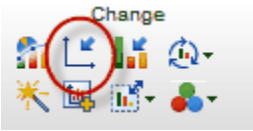
Hiding the X or Y axis. Or both.

Prism lets you hide either the X- or the Y-axis and show scale bars instead.



To hide and axis and show a scale bar instead:

Double-click on an axis to open the Frame and Origin tab of the Format Axes dialog. Or click on the Format Axis tool in the Prism toolbar.



Choose to hide one or both axes in the Frame & Origin section. You can also choose to Show Scale Bars.

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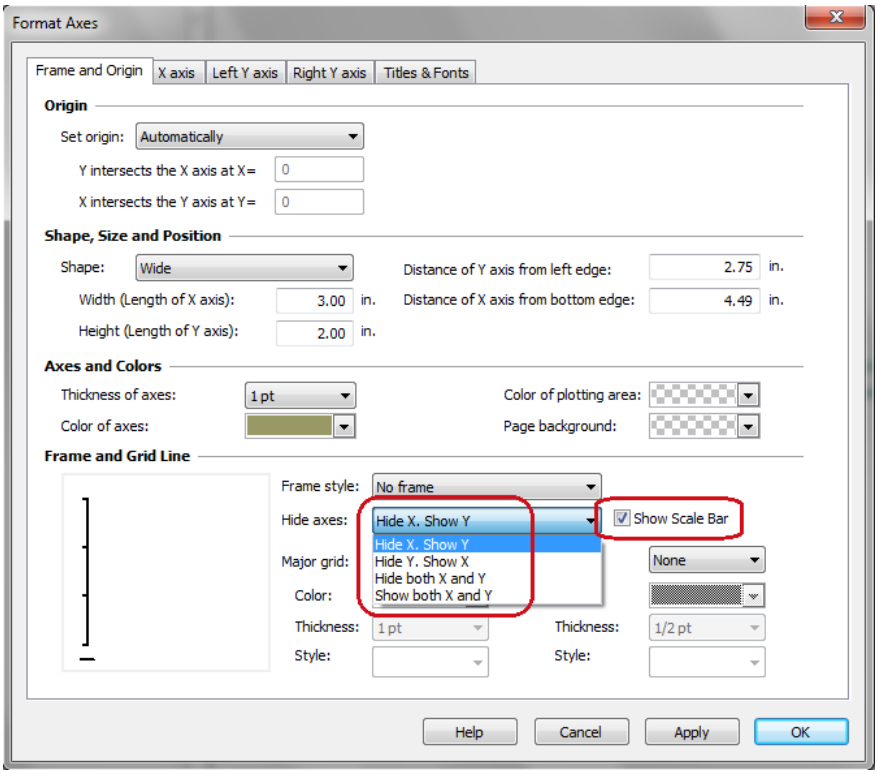

Scale bars

To show or hide the scale bar:

If you choose to hide either axis, a new option will appear in the Frames and axes section of the Format Axes dialog: Show Scale Bar. Check this option to see scale bars; uncheck to hide scale bars.The length of the scale bar equals one axis interval, set in the Regularly Spaced Ticks section of the Format Axes dialog.

To delete a scale bar:

Click on a scale bar to select it, and then press DEL to delete it.

To change the color or thickness of a scale bar:

Double-click the scale bar to bring up the Format Object dialog. Choose color and thickness in this dialog.

To remove the caps on the end of the scale bar:

By default the scale bars are capped. These are actually "arrowhead" styles. To change, double-click the scale bar to bring up the Format Object dialog. Then change the arrowhead settings.

To move a scale bar:

Drag with the mouse. Or click to select, and then nudge by clicking the arrow keys.

To label a scale bar:

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Scale bars don't include any numbering. To create a label for a scale bar, click the text tool ("T" button), click near the scale bar, and type.

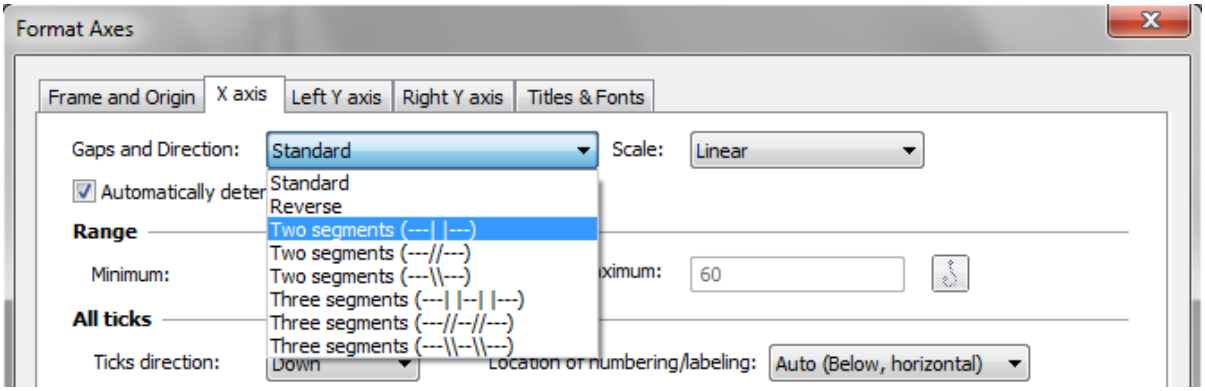
To change the length of the scale bar:

You can't change the length of a scale bar by stretching it. Instead, bring up the Format Axes dialog and change the tick interval in the Regularly Spaced Ticks section.

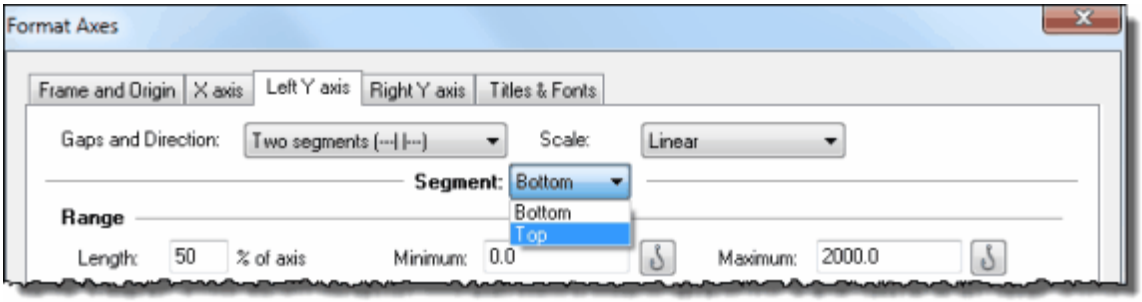
14.5.2.5 Discontinuous axes

Creating a gap in an axis

When plotting scientific data, you will often want to create a discontinuous axis - and axis with one or two gaps. Double-click on the axis to open the Format Axes dialog. In the Gaps and Directions section, you can choose either a two-segment (one gap) or three-segment (two gaps) axis.



Set the range of each segment and its length as a percent of the total length of the axis.



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Finally, choose the spacing and properties of minor and major ticks separately for each axis segment.

Limitations:

- You cannot make one segment have a logarithmic or probability scale 521 without making all the segments have such a scale.
- You cannot make one segment go in reverse while the other segment(s) go in the usual direction.
- You can only create discontinuities in the X axis of XY and Survival graphs, not Column and Grouped graphs.

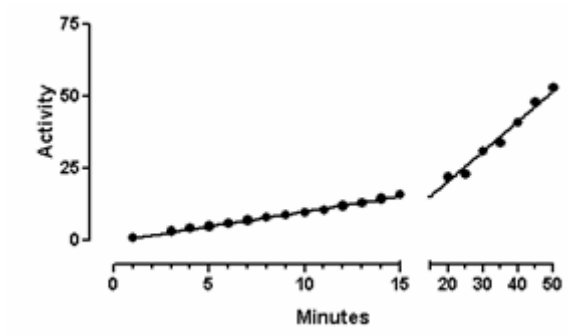
Adjusting the position of the gap on the graph and the width of the gap

To move the gap along the axis, or make the graph wider or narrower, click on an axis segment to select it and then:

- Drag the knob just to the left of (or below) the gap to change the position of the gap along the axis (make one segment larger, and another smaller).
- Drag the knob to the right of (or above) the gap to widen or narrow the gap itself.

Examples

Example 1



- Left segment range: 0 to 15
- Left segment length: 67% of the total

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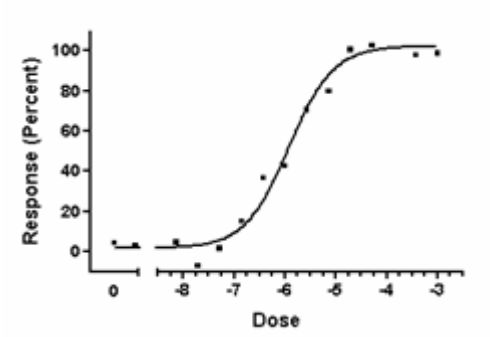
- Right segment range: 15 to 50
- Right segment length: 33% of the total.

Because of the change in scale, the linear regression line appears to have two slopes. In fact the mathematical slope is identical everywhere, and the line was created by a single analysis of all the data. The slope just appears steeper in the right half of the graph because the time scale is more compressed.

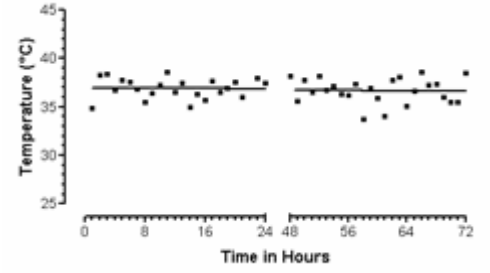
Example 2



- Left segment range: -9.5 to -8.5
- Left segment length: 12% of the total
- Right segment range: -8.5 to -2.5
- Right segment length: 88% of the total

To place "0" on the left segment, create an additional tick label at X=-9 and enter the text "0".

Example 3



- Left segment range: 0 to 24
- Left segment length: 50% of the total

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- Right segment range: 48 to 72
- Right segment length: 50% of the total

The line was drawn by linear regression, which automatically skips over the axis gap.

14.5.2.6 Additional ticks and grids

Prism let's you add up to 30 additional ticks or grid lines at defined positions along the axis. A discontinuous axis has two or three segments, and the limit of 30 additional ticks or grid lines applies to each segment separately.

To create additional ticks or grid lines:

Double-click on an axis to open the Format Axes dialog. In the Additional Ticks and Grid Lines section, set the coordinate on the axis where the tick or line should appear. Check the box to show either a tick or a grid line. If the coordinate is at a location where there already is a regular number or label, the label you enter in the Additional ticks section is shown and the regular label will be hidden.

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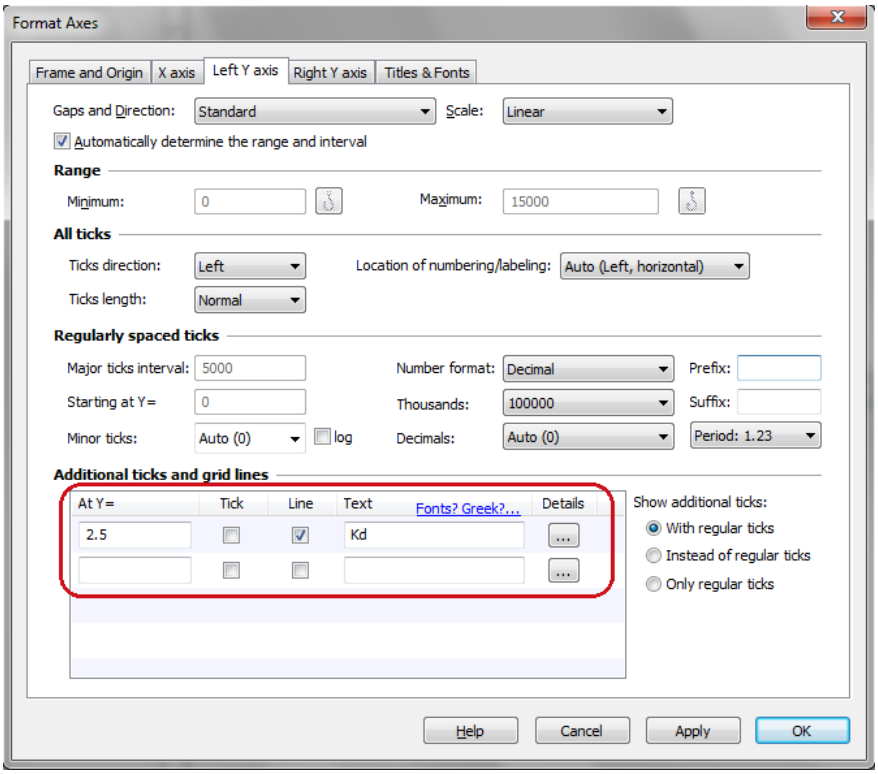

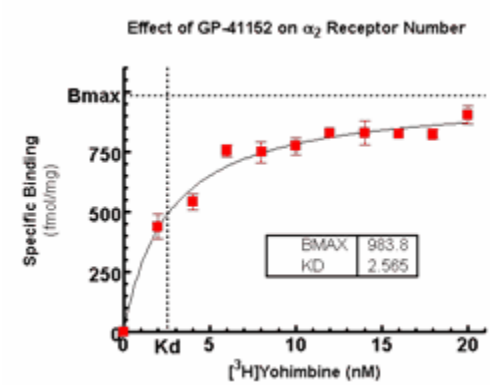

To format an additional tick:

Click on the Details button of the Additional Ticks and Grid Lines section of the Format Axes dialog. This appears as a gear on Prism Window, and as "..." on Prism Windows. This lets you format how the tick or grid line will look and add text to the label.

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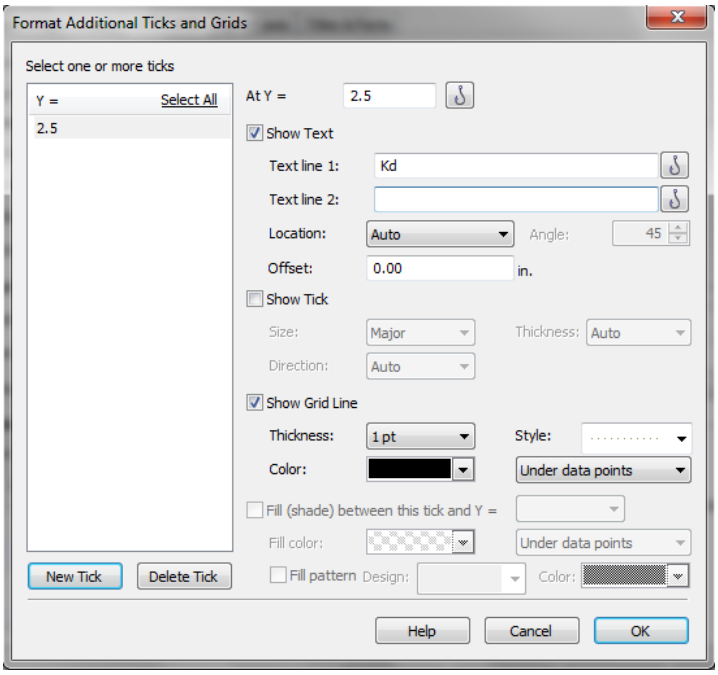
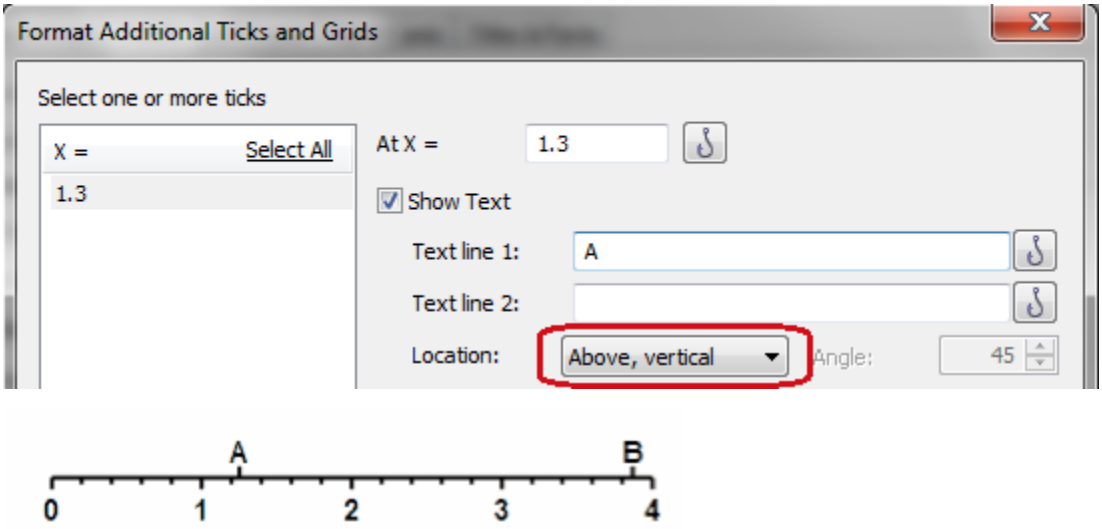


Choose whether you want each tick in line with or across from the regular ticks.



You also can Hook 306 the text of the label to an analysis or Info Sheet constant 185.

To add a fill between additional ticks or grid lines

Check the option to fill between two ticks, and choose the fill color and pattern.

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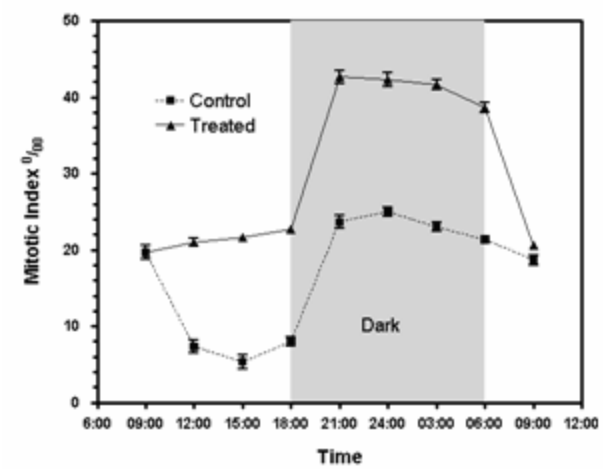
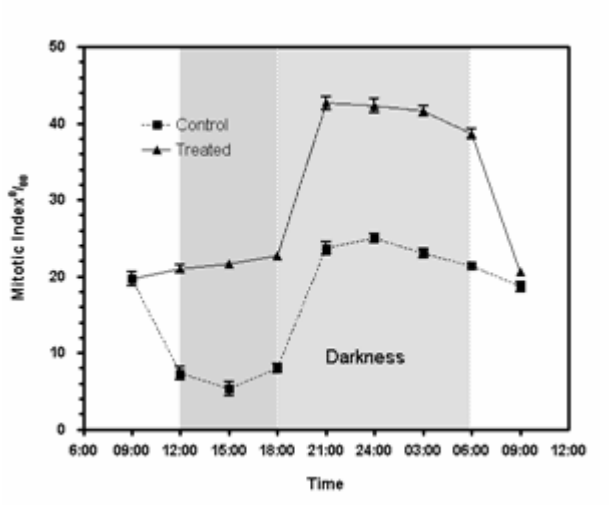


To create adjoining fills

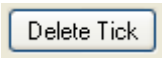
Prism can only fill the space between an Additional Grid line and one of its neighbors. To create fills on both sides of a grid line, place two additional grid lines at the same position and fill backward from one and forward from the other.



To remove or change an additional tick:

Double-click on the axis to bring up the Format Axes dialog. Locate the tick you want to change in the Additional Ticks and Grid Lines section.

Click the Details button to open the Format Additional Ticks and Grid lines section and click on the Delete Tick button.



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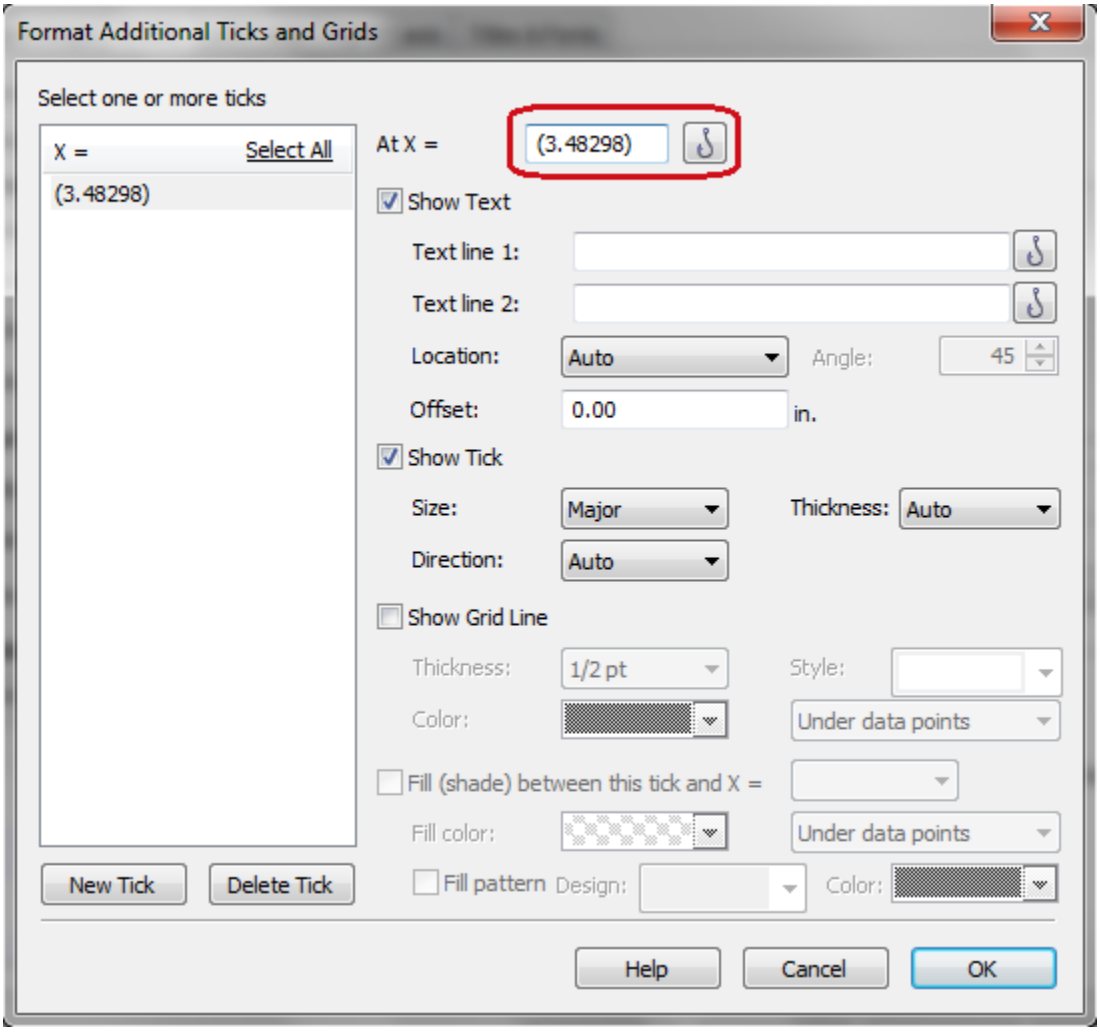
To create an additional tick or grid line by hooking an info or analysis constant:

The coordinate, or text, of an additional tick can be hooked to an analysis constant 306 or info constant 185. Click on the Details button in the Additional Ticks and Grid lines section and then on the Hook icon in the Format Additional Ticks and Grids section and select the constant you wish to link to.



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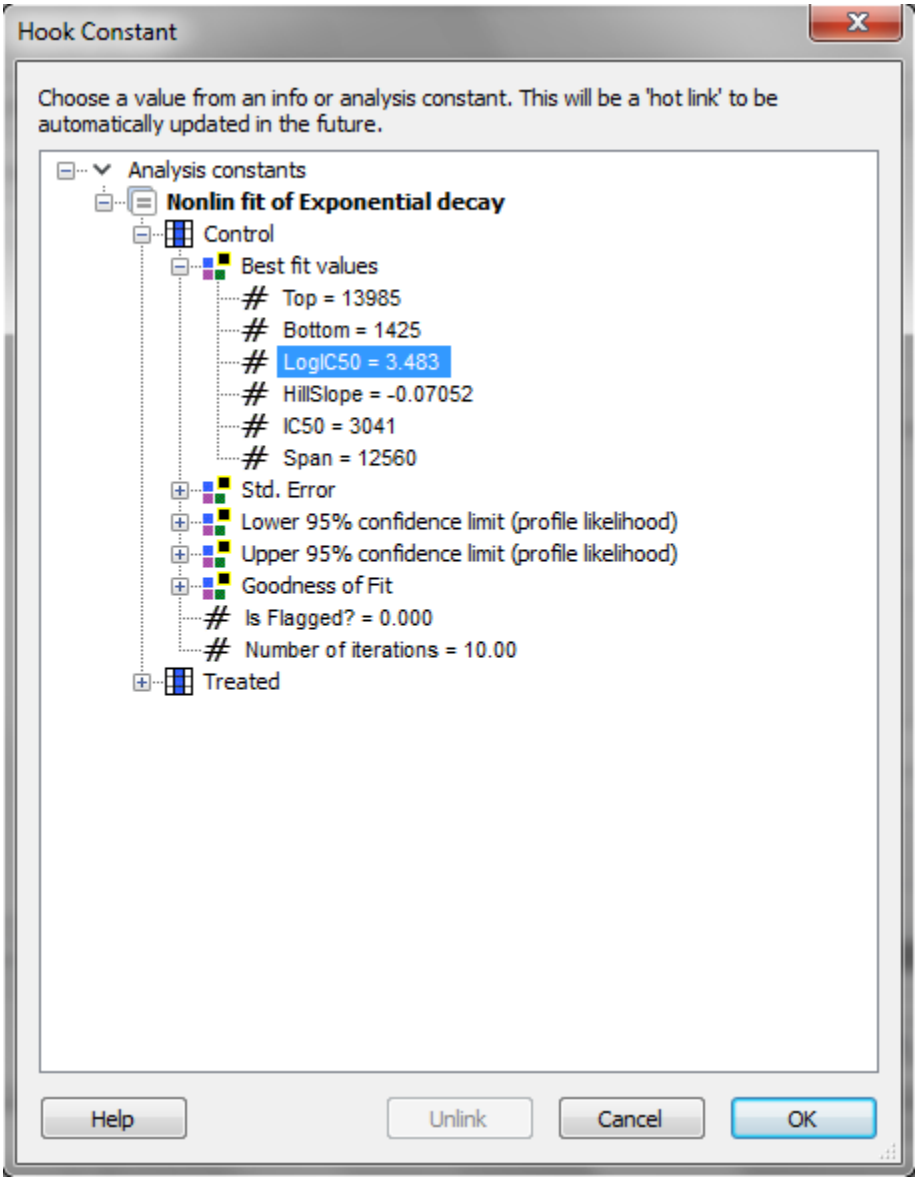

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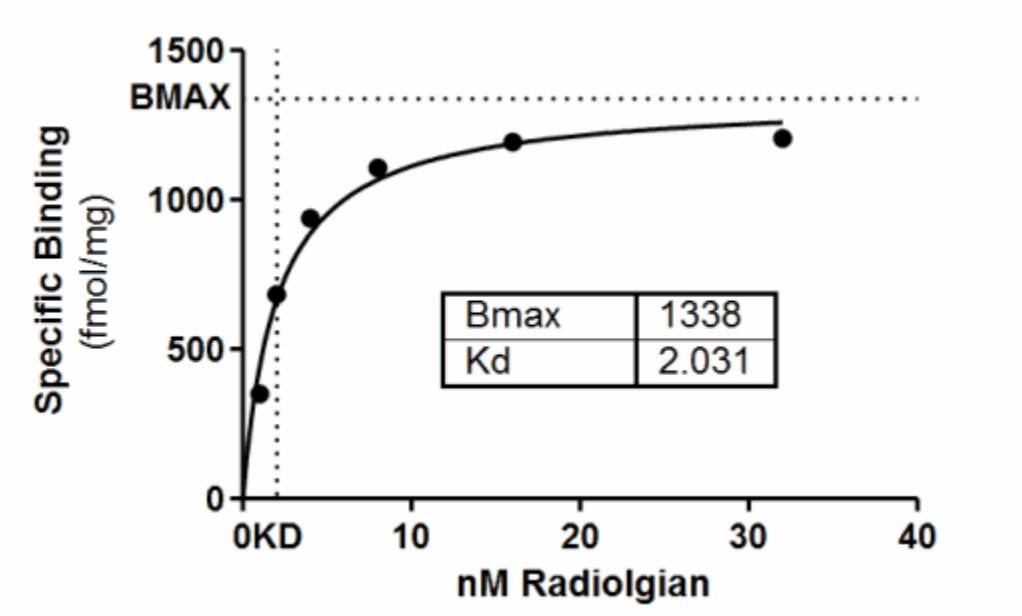


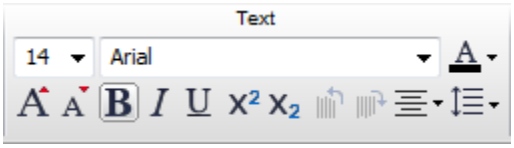
In this example, the dashed line for Kd and BMax were hooked to the Kd and BMax values in fit by nonlinear regression. If the raw data are subsequently changed, both the results information and this grid lines will update.

14.5.2.7 Axis titles

By default, Prism puts generic titles on top of the graph and on the X- and Y-axes.

To edit a title:

Click in the title to select it. If you are editing a Y-axis title, it will be temporarily displayed horizontally for editing. Edit (or replace) the text. To enter more than one line, press Enter between lines. When you are done, click in the background of the graph. While editing the title, you can use controls in the text toolbar.



To delete a title:

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Drag over the title to select it. If you are editing a Y-axis vertical title, it will be temporarily displayed horizontally for editing. Then press the DEL key.

To bring back a deleted title:

Double-click an axis to open the Format Axes dialog. Check "Show title" in the Titles and Fonts tab of Format Axes dialog.

To change the font of a title:

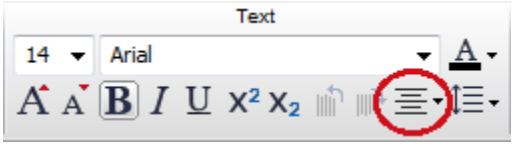
Select the title, or a portion of it, and use Font tools on the toolbar. Or double-click on the axis to open the Format Axes dialog, go to the Titles&Fonts tab, and click the Font button.

To make a title a bit smaller or bigger.

Select the title, Then press the A or A buttons on the toolbar to change the point size.

To justify a title:

Usually a title is centered over the graph or axis. To justify the title with the right or left edge of the axis, select the title and click on the text justify button on the Text toolbar.



To move a title:

Move the mouse near the title until the cursor turns into a two-headed arrow ⇕ . Then hold down the primary mouse button and drag the title into position. Alternatively, go to the Titles and Fonts tab of the the Format Axes dialog, where you can position the title by entering the desired distance between the axis and the title.

A graph title is always centered over the graph, and an axis title is always centered on the axis. If you want noncentered titles, delete the title and then create a separate text object which can be positioned anywhere.

To hide a title, or rotate a title:

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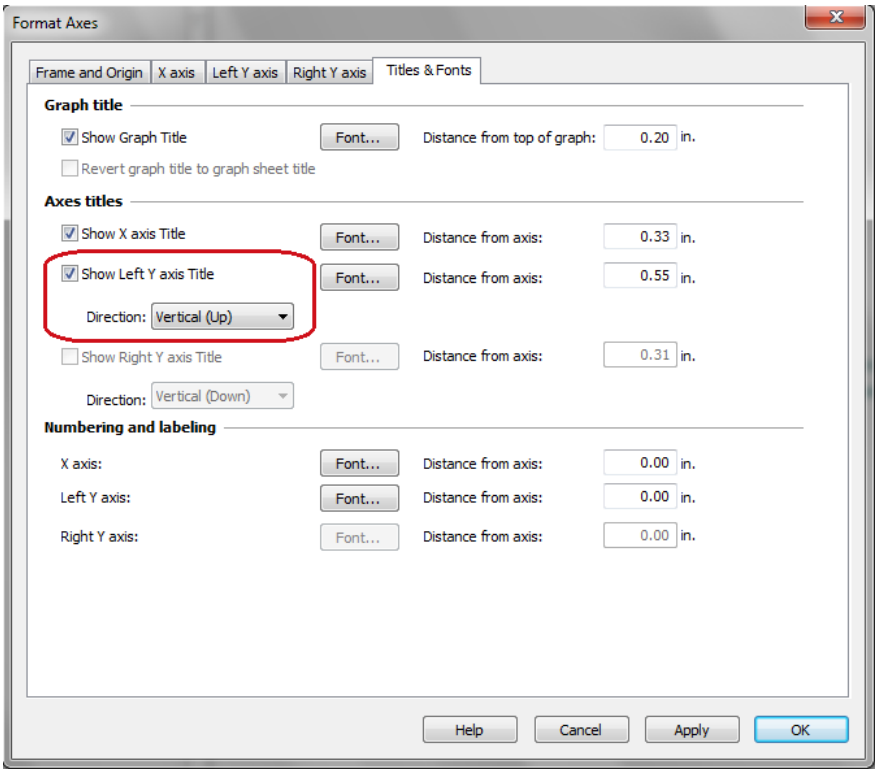
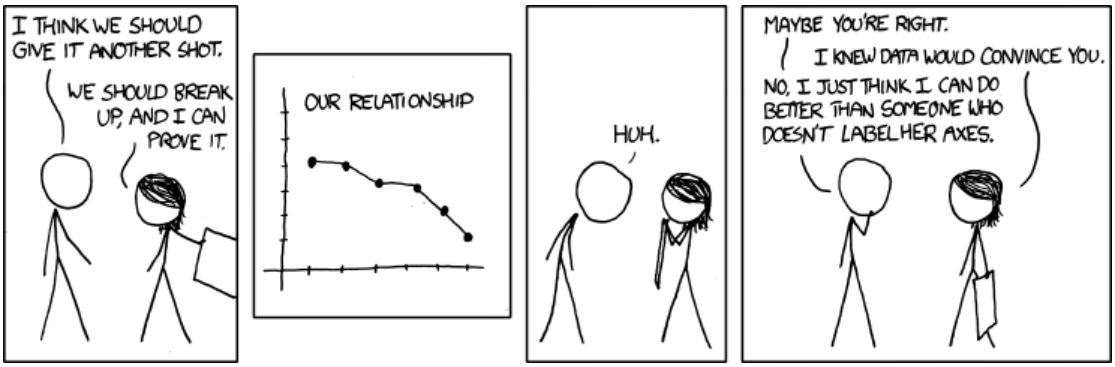
Double-click an axis to open the Format Axes dialog. Uncheck options to hide any of the titles. For both Y axes you have the choice to make the title vertical or horizontal.



To change the default font and size used for new graphs:

Pull down the Edit menu (the Prism menu in Mac OS X), and choose Preferences, then go to the New Graphs tab.

Why you want to put titles on axes!



From XKCD.

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14.5.3 Labeling axes with dates and times

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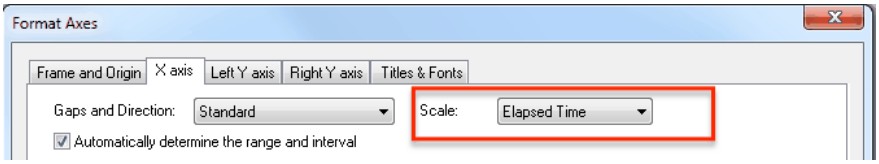
14.5.3.1 Elapsed time

This page explains how to make graphs when you entered X values as elapsed time 241. Another page 516 explains how Prism 6 and earlier dealt with dates and times.

The Format Axis dialog offers two new choices when you entered elapsed times instead of X values. '

Elapsed time scale

At the top of the dialog, choose to use a Elapsed Time scale.



If you choose an Elapsed time scale, you can choose to display just hours, hours:minutes, hours:minutes:seconds or hours:minutes:seconds.milliseconds. To avoid overlap, you'll probably want the dates to be displayed vertically or at an angle (not horizontal).

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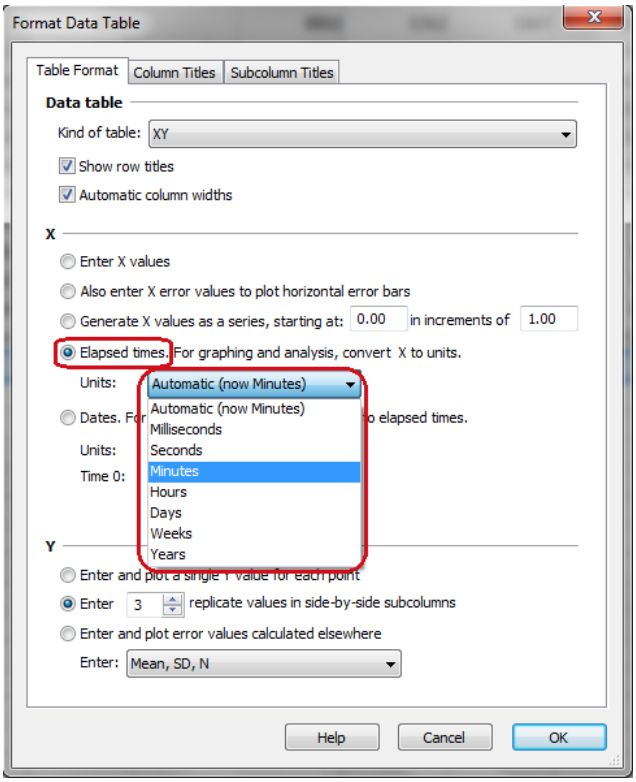
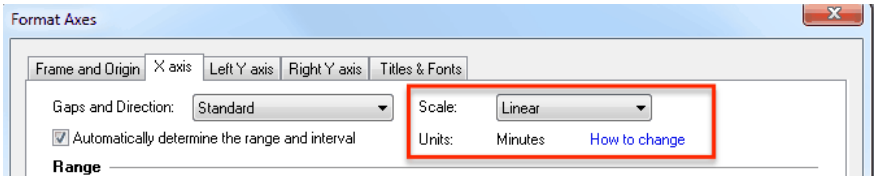


Linear scale for X values entered as elapsed time

If you choose a linear (numerical) scale, Prism tells you what the units will be. These units are set on the data table.



To change those units, go back to the data table, drop the Change menu, choose Format Data Table 238, and then select the units you want to use.

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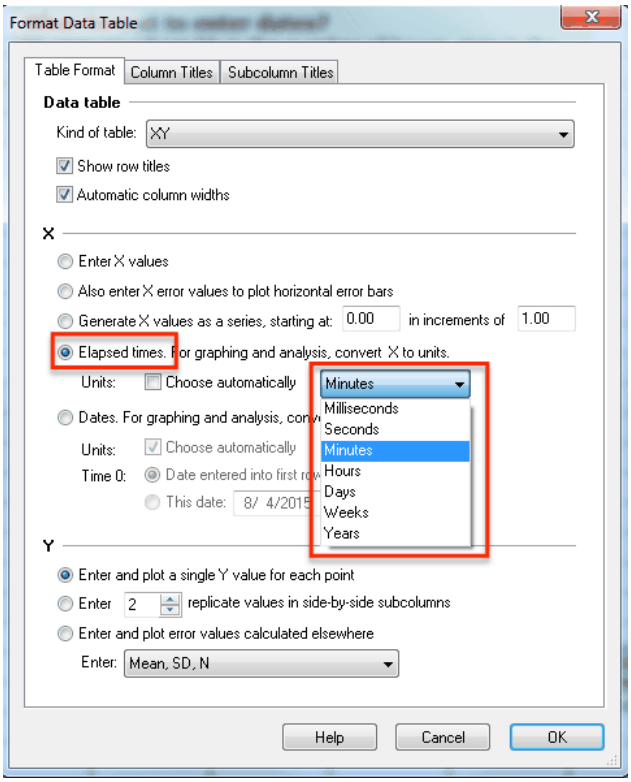

What values are used when you fit a curve or line to the data?

When you analyze an XY table with X values entered as elapsed times, Prism converts the elapsed times to numbers. To change the units (seconds, minutes,...), go back to the data table, drop the change menu, and choose Format Data Table.

Note that the choice of months is not offered, because months have different lengths. Years also have different lengths, so if you choose years, Prism does the conversion based on 365.25 days per year.

14.5.3.2 Dates

This page explains how to make graphs when you entered dates as X values 241. Another page 516 explains how Prism 6 and earlier dealt with dates.

The Format Axis dialog offers two new choices when you entered dates instead of X values.

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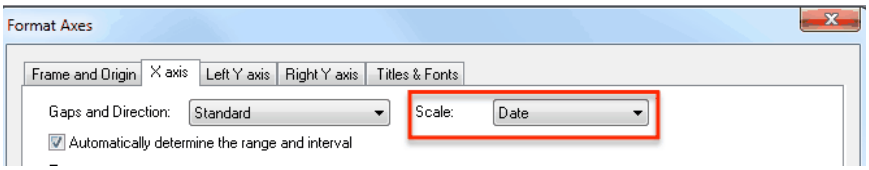
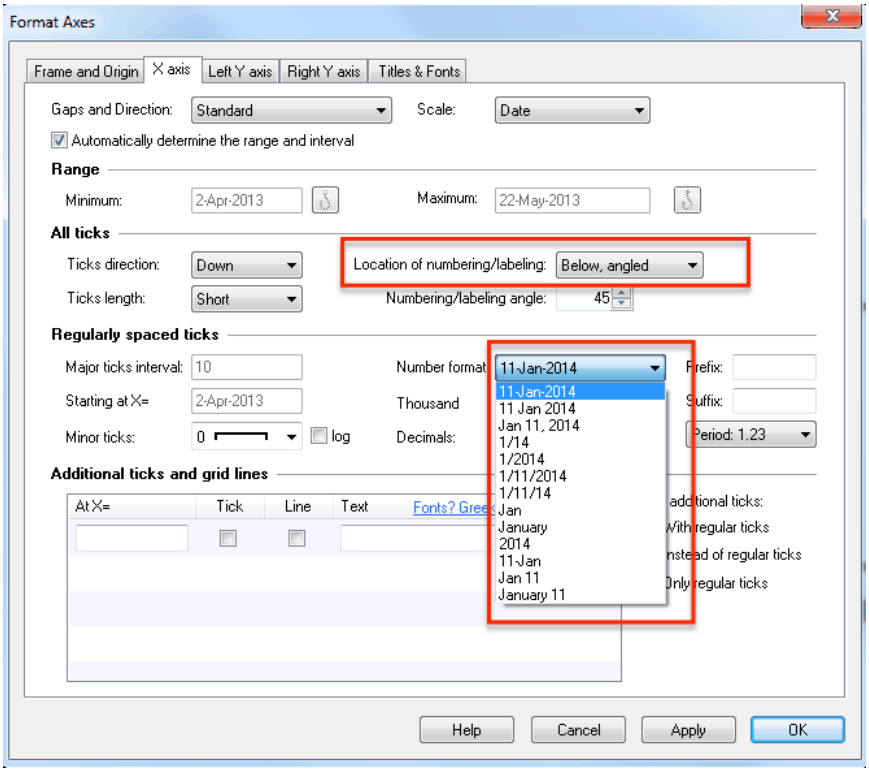
Date scale

At the top of the dialog, choose to use a Date scale.



If you choose a Dates scale, you can choose many ways to display the dates. To avoid overlap, you'll probably want the dates to be displayed vertically or at an angle (not horizontal).



When you choose a Dates axis scale, Prism is smart about how far to space the dates. Jan 3 is much closer to Jan 1 than is Feb 3...

Linear scale for X values entered as dates

If you choose a linear (numerical) scale for X values entered as dates, Prism tells you what the units will be.

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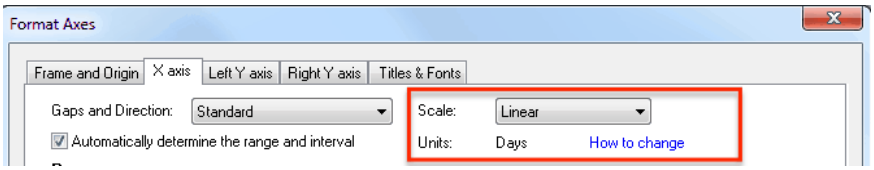
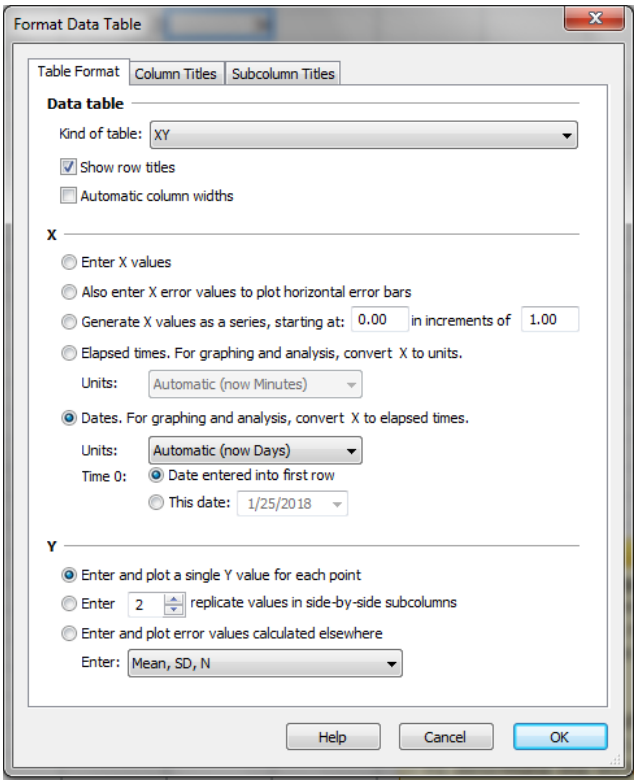


To change those units, go back to the data table, drop the Change menu and choose Format Data Table.



What values are used when you fit a curve or line to the data?

When you analyze XY data where X values are entered as dates, Prism converts the dates to numbers using a starting date and a date unit (days, weeks, etc.). To change this, go back to the data table, drop the change menu, and choose Format Data Table.

14.5.3.3 Dates (Compatible with Prism 6)

Prism 6 and earlier did not understand the concept of dates or times, so you could not enter times or dates as X values. But you plot dates i a

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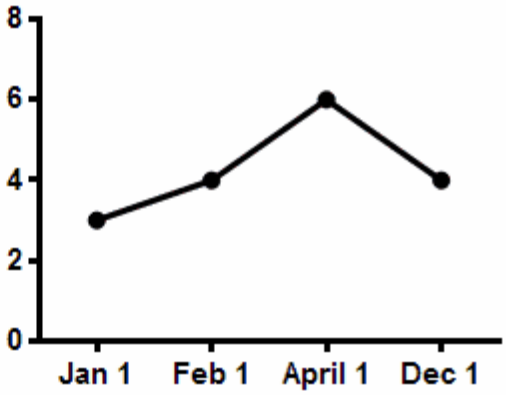
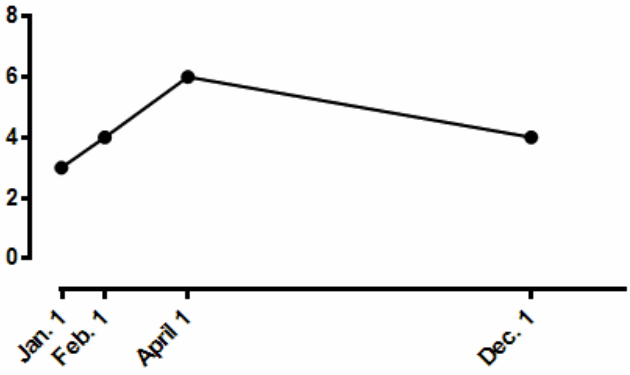
manner compatible with Prism 6 by entering dates or times as row titles.

Table format: Grouped		Group A
		Data Set-A
		Y
1	Jan 1	3
2	Feb 1	4
3	April 1	6
4	Dec 1	4



Note that Prism does not try to interpret the meaning of row titles. Those labels will always appear equally spaced on the graph, even if the dates are not equally spaced chronologically. You'll need to use a different approach to plot a series of dates that are not equally spaced to be compatible with Prism 6. Enter the data onto an XY table. Enter the dates as row titles. Into the X column, enter the number of days since some starting point.

Table format: XY		X	Group A
		# of days	Response
		X	Y
1	Jan 1	0	3
2	Feb 1	31	4
3	April 1	90	6
4	Dec 1	334	4



To make this graph, you'll need to make some changes on the Format Axis dialog. Leave the Number Format set to Decimal. Don't choose Row Titles, or you'll end up with an equally spaced graph. Use the Additional

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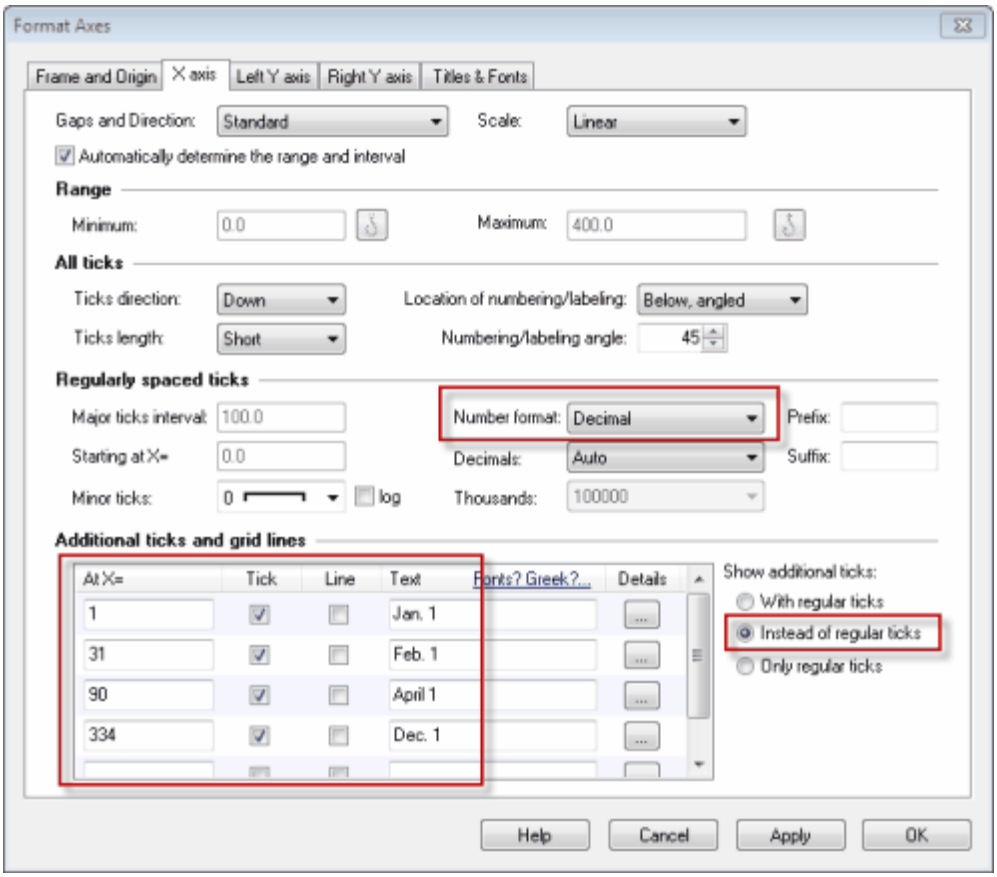
Ticks section to specify each label and its location (X coordinate). Check the option to plot only these additional ticks (instead of regular ticks).



14.5.4 Logarithmic axes

If your data span a wide range of values, it can be easier to visualize the results when you make one of the axes logarithmic. Distinguish between transforming your data to logarithms (which creates a new results table) from choosing a logarithmic axis (which only stretches the axis, without altering your data).

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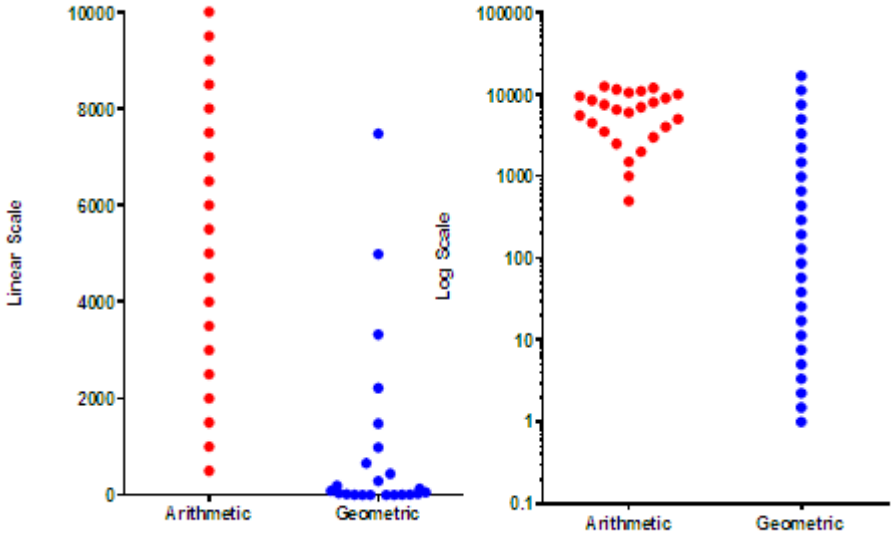
A review of logarithms 532

14.5.4.1 What is a logarithmic axis?

A logarithmic axis changes the scale of an axis

The two graphs below show the same two data sets, plotted on different axes.



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The graph on the left has a linear (ordinary) axis. The difference between every pair of ticks is consistent (2000 in this example).

The graph on the right has a logarithmic axis. The difference between every pair of ticks is not consistent. From the bottom tick (0.1) to the next tick is a difference of 0.9. From the top tick (100,000) down to the next highest tick (10,000) is a difference of 90,000). What is consistent is the ratio. Each axis tick represents a value ten fold higher than the previous tick.

The red dots plot a data set with equally spaced values. Each dot represents a value with a Y value 500 higher than the dot below. The dots are equally spaced on the graph on the left, but far from equally spaced on the graph on the right. To prevent overlap, the points are jittered to the right and left so they don't overlap. The horizontal position of the red dots has no other meaning.

The blue dots represent a data set where each value represents a Y value 1.5 times higher than the one below. On the graph on the left, the lower values are almost superimposed, making it very hard to see the distribution of values (even with horizontal jittering). On the graph on the right with a logarithmic axis, the points appear equally spaced.

Why “logarithmic”?

In the example above, the ticks at 1, 10, 100, 1000 are equally spaced on the graph. The logarithms of 1, 10, 100 and 1000 are 0, 1, 2, 3, which are equally spaced values. Since values that are equally spaced on the graph have logarithms that are equally spaced numerically, this kind of axis is called a “logarithmic axis”.

Interpolating between log ticks

What value is halfway between the tick for 10 and the one for 100 on a logarithmic axis? Your first guess might be the average of those two values, 55. But that is wrong. Values are not equally spaced on a logarithmic axis. The logarithm of 10 is 1.0, and the logarithm of 100 is 2.0, so the logarithm of the midpoint is 1.5. What value has a logarithm of 1.5? The answer is 101.5, which is 31.62. So the value half way between 10 and 100 on a logarithmic axis is 31.62. Similarly, the value halfway between 100 and 1000 on a logarithmic axis is 316.2.

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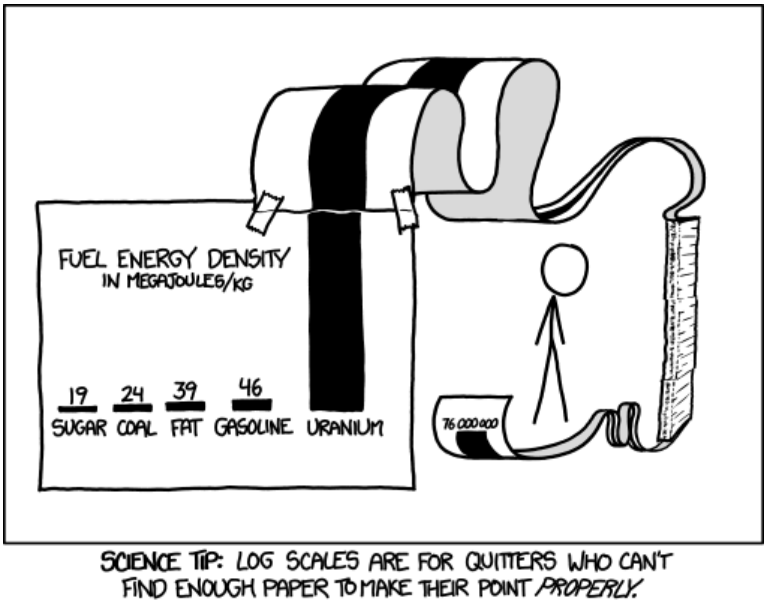
Lingo

The term *semilog* is used to refer to a graph where one axis is logarithmic and the other isn't. When both axes are logarithmic, the graph is called a *log-log* plot.

Advantages of a logarithmic axis

One advantage, as shown above, is that a lognormal distribution is easier to see on a logarithmic axis. Another reason to prefer a logarithmic axis is when the values span a large (many orders of magnitude) range of values and otherwise wouldn't really fit on a linear graph. At least not without a lot of creativity (from xkcd)!



14.5.4.2 How to: Create a log axis

This page shows how to stretch the axis to a logarithmic scale (which doesn't alter your data). Distinguish this from transforming your data to logarithms, which you can plot 529.

To create a log axis:

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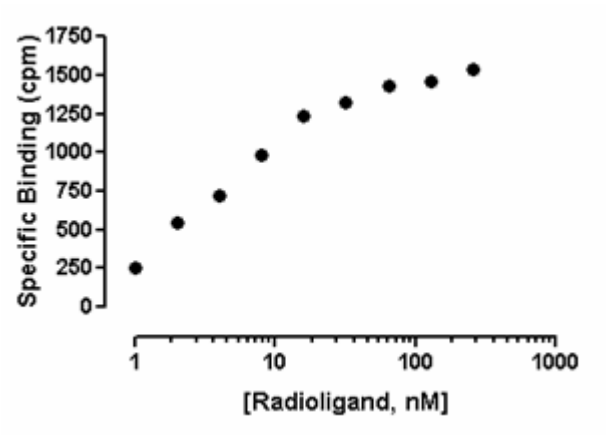
Double-click on the axis to open the Format Axes dialog. In the Scale section, set the axis to Log10 or Log 2.

This graph shows log spaced minor ticks. The minor ticks between the major ticks at 10 and 100 show the position of 20, 30, 40, 50, 60, 70, 80 and 90. Since the minor ticks are not equally spaced on the graph, we call these log spaced minor ticks. Note that there are eight ticks, so nine intervals (many people mistakenly think there ought to be ten).



To set the numbering for a log axis:

Double-click on the axis to open the Format Axes dialog and set the number format in the Numbering or Labeling section. Prism offers three numbering format choices for log axes.

Antilog: 10, 100, 1000, 10000, etc.

Scientific: $1x10^1$, $1x10^2$, $1x10^3$, $1x10^4$,etc.

Power of 10: 10^1, 10^2, 10^3, 10^4,etc.

Log: 1, 2, 3, 4, etc.

To set the minor tick intervals for a log axis:

Double-click on the axis to open the Format Axes dialog and set the number format in the Numbering or Labeling section. Choose Equal or Log spacing, and the number of intervals you want between major ticks, not the number of ticks.

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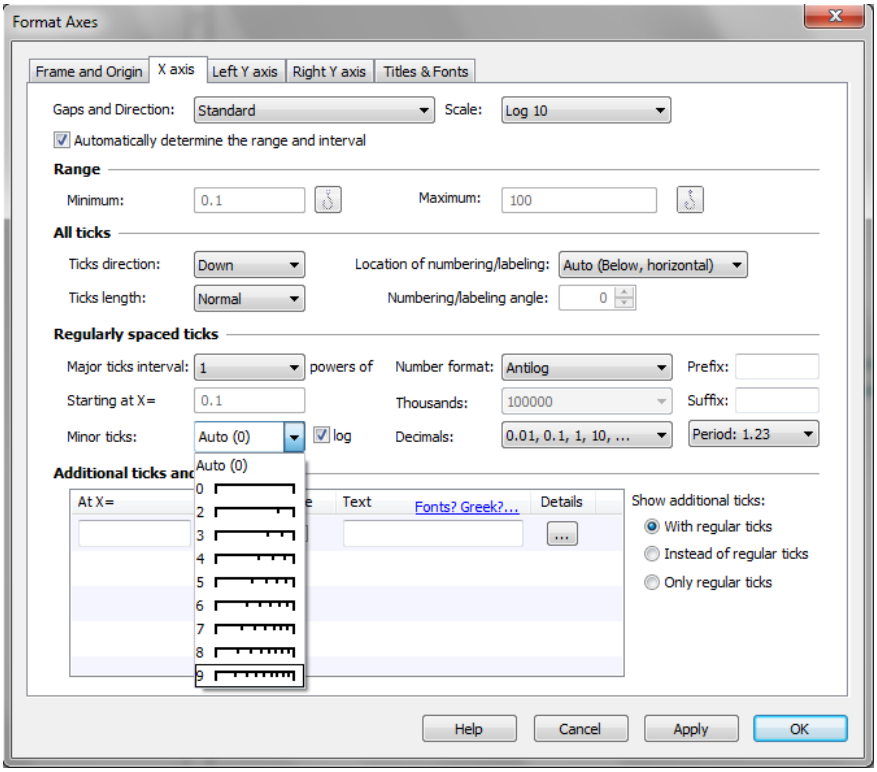

14.5.4.3 Logarithmic axes cannot contain zero or negative numbers

The logarithms of negative numbers and zero are simply not defined

Let's start with the fundamental definition of a logarithm. If $10^L = Z$, then L is the logarithm (base 10) of Z. If L is a negative value, then Z is a positive fraction less than 1.0. If L is zero, then Z equals 1.0. If L is greater than 0, then Z is greater than 1.0. Note that there no value of L will result in a value of Z that is zero or negative. Logarithms are simply not defined for zero or negative numbers.

Bottom line: A logarithmic axis can only plot positive values. There simply is no way to put negative values or zero on a logarithmic axis.

A trick to plot zero on a logarithmic axis in Prism

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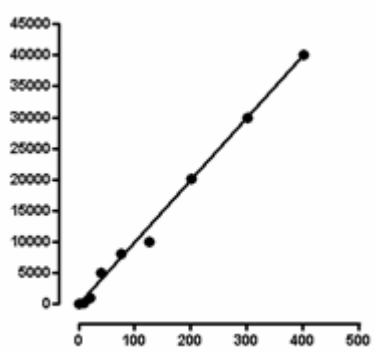
If you really want to include zero on a logarithmic axis, you'll need to be clever. Don't enter 0, instead enter as a small number. For example, if the smallest value in your data is 0.01, enter the zero value as 0.001. Then use the Format Axis dialog to create a discontinuous axis, and use the Additional ticks feature of Prism to label that spot on the axis as 0.0.

14.5.4.4 Regression fits the data, not the graph

Choosing a log scale changes the way the graph looks, but does not change the data values. Linear or nonlinear regression fit an equation to your data. Your choice of axis scaling does not affect any calculations.

The three graphs shown below represent the same data by linear regression.

The graph below has linear X and Y axes, so the linear regression line appears straight.



The graph below has a logarithmic X axis. The curve you see is the results of linear regression. It is the best fit to the equation Y=intercept + slope*X. The X values used by the linear regression are the X values you entered. Graphing this linear regression line on a log axis results in a curve.

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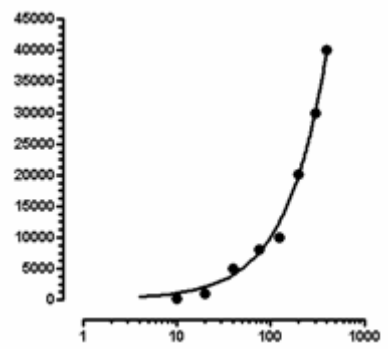
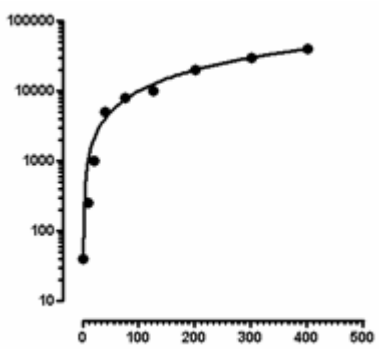


The graph below has a logarithmic Y axis. Again, the best-fit linear regression line appears curved when plotted on a logarithmic axis.



14.5.4.5 When to use a logarithmic axis

A logarithmic X axis is useful when the X values are logarithmically spaced

The X axis usually plots the independent variable – the variable you control. If you chose X values that are constant ratios, rather than constant differences, the graph will be easier to view on a logarithmic axis.

The two graphs below show the same data. X is dose, and Y is response. The doses were chosen so each dose is twice the previous dose. When plotted with a linear axis (left) many of the values are superimposed and it is hard to see what's going on. With a logarithmic axis (right), the values are equally spaced horizontally, making the graph easier to understand.

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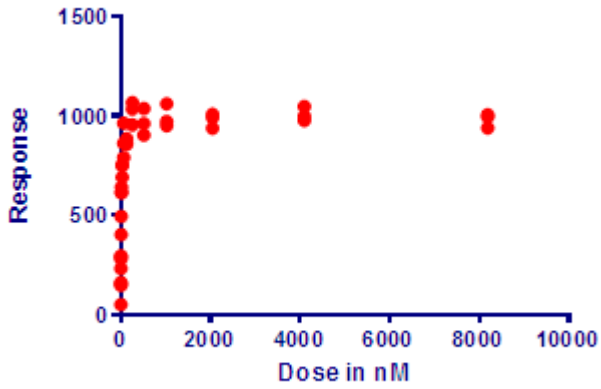
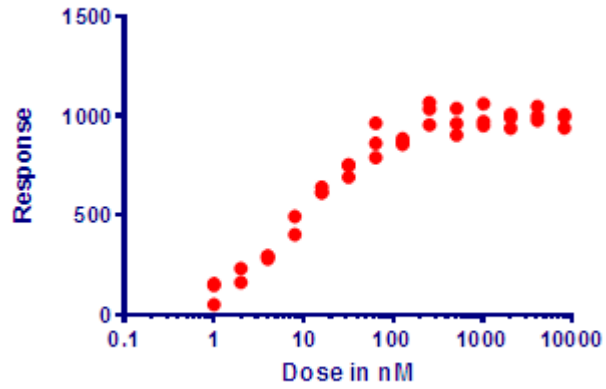
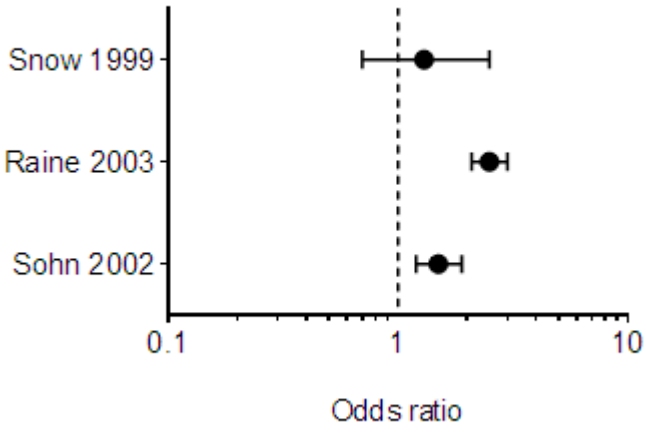


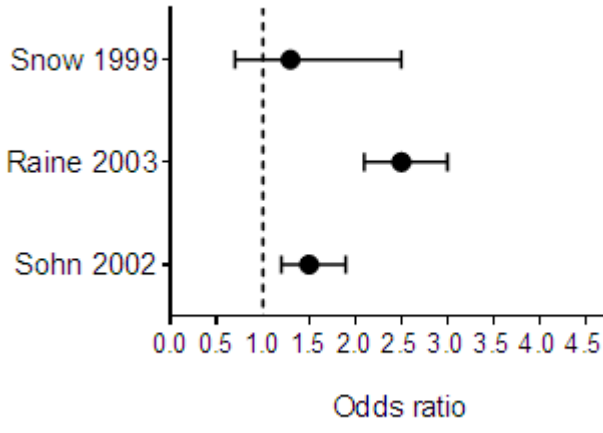


A logarithmic axis is useful for plotting ratios

Ratios are intrinsically asymmetrical. A ratio of 1.0 means no change. All decreases are expressed as ratios between 0.0 and 1.0, while all increases are expressed as ratios greater than 1.0 (with no upper limit).

On a log scale, in contrast, ratios are symmetrical. A ratio of 1.0 (no change) is halfway between a ratio of 0.5 (half the risk) and a ratio of 2.0 (twice the risk). Thus, plotting ratios on a log scale (as shown below) makes them easier to interpret. The graph below plots odds ratios from three case control retrospective studies, but any ratio can benefit from being plotted on a log axis.





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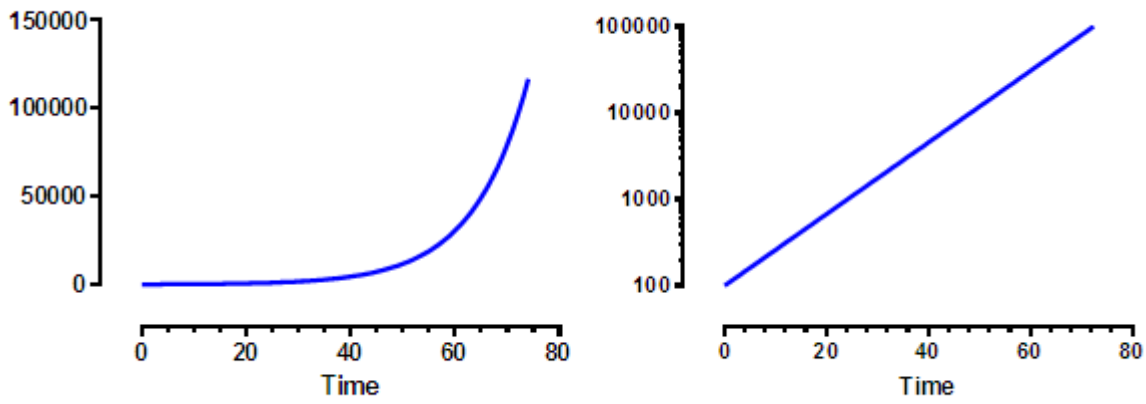
The graph above was created with the outcome (the odds ratio) plotted horizontally. Since these values are something that was determined (not something set by the experimenter), the horizontal axis is the Y axis even though it is horizontal.

A logarithmic axis linearizes compound interest and exponential growth

The graphs below plot exponential growth, which is equivalent to compound interest. At time = 0.0, the Y value equals 100. For each increment of 1.0 on the X axis, the value plotted on the Y axis equals 1.1 times the prior value. This is the pattern of cell growth (with plenty of space and nutrients), and is also the pattern by which an investment (or debt) grows over time with a constant interest rate.



The graph on the right is identical to the one on the left, except that the Y axis has a logarithmic scale. On this scale, exponential growth appears as a straight line. Exponential growth has a constant doubling time. For this example, the Y value (cell count, value of investment) doubles for every time increment of 7.2657.

Exponential decay is also linearized on a logarithmic axis, but only when the decay eventually decays to zero.

14.5.4.6 Advice: Bar graphs with log axes rarely make sense

Prism can create bar graphs with a logarithmic Y axis, but think twice before deciding to make this kind of graph. The point of a bar graph is to

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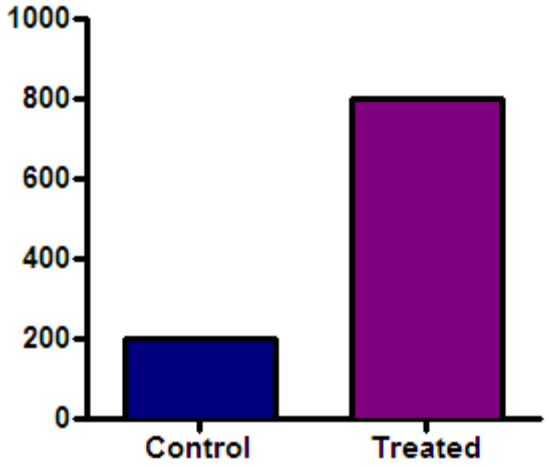
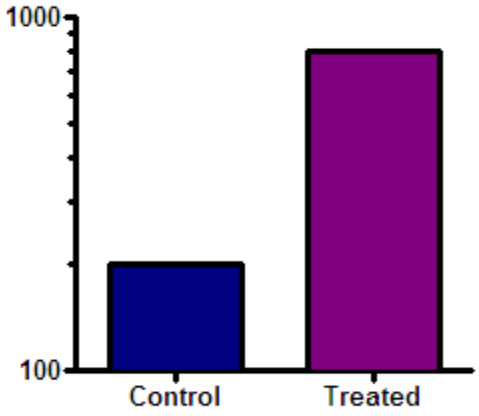
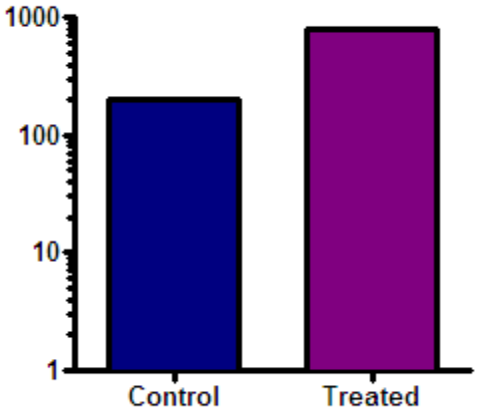
let people compare heights or areas of the bars. In most cases, you should try to avoid using a log axis when creating a bar graph.

The treated bar in the graph below (with a linear axis) is four times as tall (and has four times the area) as the control bar. This tells you that the treatment increased the response fourfold. This is very straightforward since the Y axis is linear.



Beware of bar graphs with a logarithmic axis. Since zero can't be shown on a log axis, you need to decide where to begin the axis. A log scale has no logical starting place, so the choice is arbitrary. The graphs below show the same data as the graph above, but with the Y axis beginning at 0.001, 10 or 100.





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The relative height of the bars appears to be almost the same in the graph on the right and very different on the graph on the left. The relative heights (or areas) of the bars on a log scale is not informative.

If the goal is to create propaganda, a bar graph using a logarithmic axis is a great tool, as it lets you either exaggerate differences between groups or minimize them. All you have to do is carefully choose the range of your axis to give the impression you want to project. If your goal is to honestly show the data, don't create bar graphs using a logarithmic axis

The only case that I know of where it makes sense to plot bars on a logarithmic axis is when the Y axis is plotting the fold change in something. Then the baseline of 1.0 is logical (no change), as is a logarithmic scale.

14.5.4.7 Graphing logarithms - different than using a log axis

Transforming data to logs

If you need log data for your analysis, you can either enter logs directly or transform your data. For example, you should fit a sigmoidal dose-response equation to data expressed with X as logarithm of dose. If you enter concentrations, you'll need to convert them to logarithms before using nonlinear regression.

To transform your data to logs:

Click the Analyze button, choose built-in analyses, and then select Transforms from the list of data manipulations. Choose X = log(X).

Also check the box at the bottom of the dialog to Create a New Graph of the results. Prism will create a results table of the transformed data, and a new graph. To perform nonlinear regression on the transformed data, click Analyze from either the results table or the new graph.

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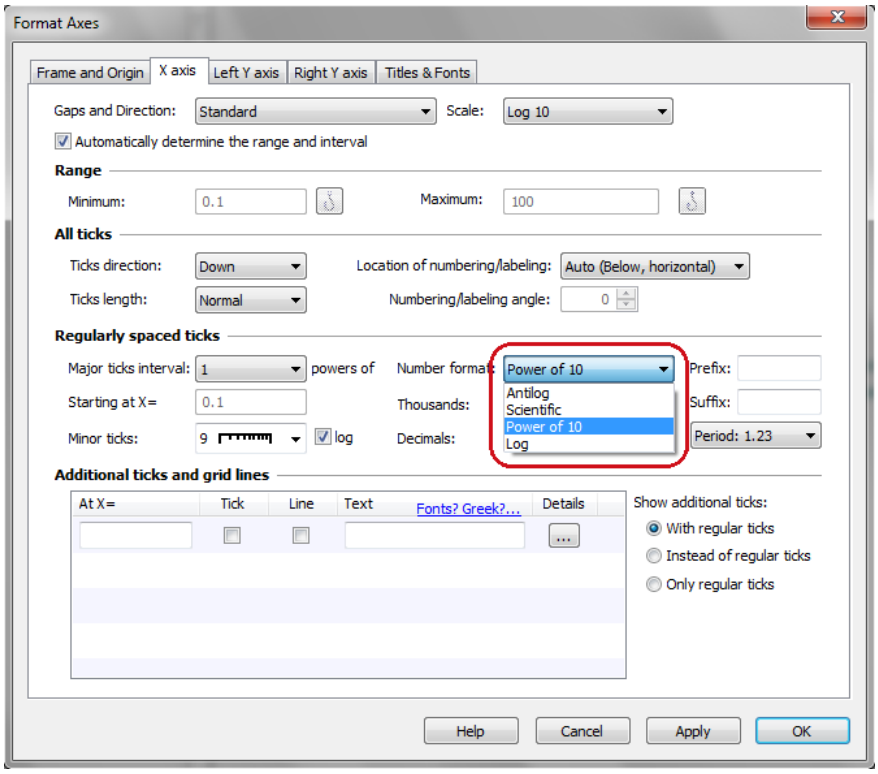
Plot data already entered as logarithms

If you enter data as logarithms, or graph the results of a log transform, you should graph the data with a linear axis. Don't choose a log scale! Your data are already logarithms. If your data represent logarithms, you can format the axis numbering to make this clear.



The figure below compares the appearance of decimal (the default), powers of ten, and antilog formatting.

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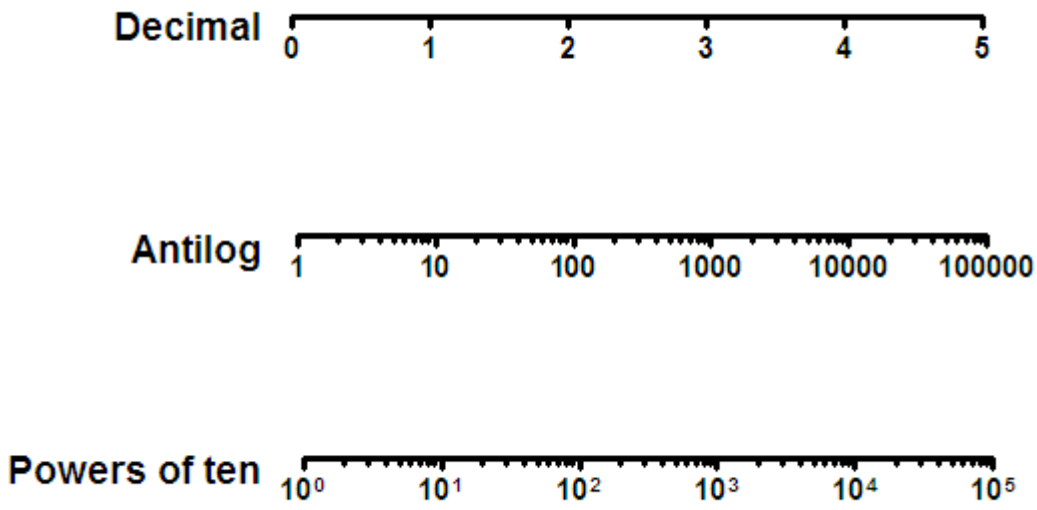
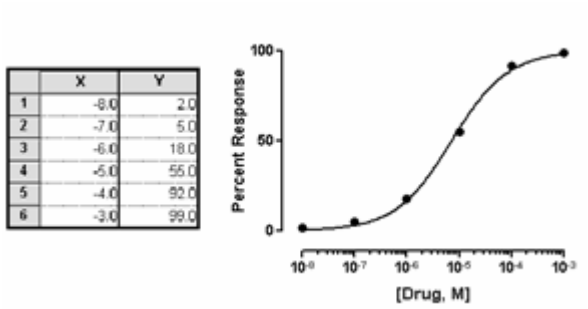


In the graph below, the X values represent the logarithm of concentration. The logs were entered directly into the X column of the data table. The graph of these data has a linear (not log) X axis. The axis was formatted with a numbering format of powers of 10, and with nine minor tick intervals with log spacing (see dialog settings below the graph).



	X	Y
1	-8.0	2.0
2	-7.0	5.0
3	-6.0	18.0
4	-5.0	55.0
5	-4.0	92.0
6	-3.0	99.0

In the graph below, An alternative way to indicate that the data are logarithms is to choose the antilog numbering format (this choice is only available when the interval is 1, the minimum is –9 or greater, and the maximum is 9 or less).

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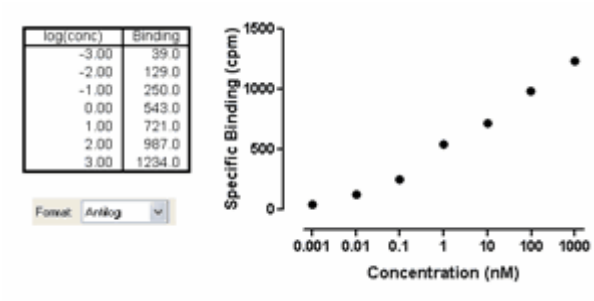

14.5.4.8 A review of logarithms

Common (base ten) logarithms

The best way to understand logarithms is through an example. If you take 10 to the third power (10 x 10 x 10) the result is 1000. The logarithm is the inverse of that power function. The logarithm (base 10) of 1000 is the power of 10 that gives the answer 1000. So the logarithm of 1000 is 3. If you multiply 10 by itself 3 times, you get 1000.

You can take 10 to a negative power. For example, taking 10 to the -3 power is the same as taking the reciprocal of 10^3. So 10^{-3} equals $1/10^3$, or 0.001. The logarithm of 0.001 is the power of 10 that equals 0.001, which is -3.

You can take 10 to a fractional power. Ten to the 1/2 power equals the square root of 10, which is 3.163. So the logarithm of 3.163 is 0.5.

Ten to the zero power equals 1, so the logarithm of 1.0 is 0.0.

You can take the logarithm of any positive number. The logarithm of values between zero and one are negative; the logarithms of values greater than one are positive. The logarithms of zero and all negative numbers are undefined; there is no power of 10 that gives a negative number or zero.

Logarithms to other bases

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The logarithms shown in the previous section are called base 10 logarithms, because the computations take 10 to some power. These are also called *common logarithms*.

You can compute logarithms for any power. Mathematicians prefer natural logarithms, using base e (2.7183…). Despite that name, use of logarithms with base e does not seem natural to most scientists who tend to be far more comfortable with base 10 logarithms.

Biologists sometimes use base 2 logarithms, often without realizing it. The base 2 logarithm is the number of doublings it takes to reach a value. So the log base 2 of 16 is 4 because if you start with 1 and double it four times (2, 4, 8, and 16) the result is 16. Immunologists often serially dilute antibodies by factors of 2, so often graph data on a log2 scale. Cell biologists use base 2 logarithms to convert cell counts to number of doublings.

Logarithms using different bases are proportional to each other. So converting from natural logs to common logs is sort of like changing units. Divide a natural logarithm by 2.303 to compute the common log of the same value. Multiply a common log by 2.303 to obtain the corresponding natural log.

Mathematical properties of logarithms

Logarithms convert multiplication into addition and division into subtraction, and exponentiation into multiplication:

```
log(A.B) = log(A) + log(B)

log(A/B) = log(A) - log(B)

log(An) = n.log(A)
```

Antilogarithms

The antilogarithm (also called an antilog) is the inverse of the logarithm transform. Since the logarithm (base 10) of 1000 equals 3, the antilogarithm of 3 is 1000. To compute the antilogarithm of a base 10 logarithm, take ten to that power.

To compute the antilogarithm of a natural logarithm, take e to that power. The natural logarithm of 1000 is 6.980. So the antilogarithm of

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6.908 is $e^{6.908}$, which is 1000. Spreadsheets and computer languages use the notation exp(6.908).

Terms that sound similar to logarithm: logit and logistic

The term *logistic* sounds like it is related to logarithms. In fact, the term logistic has three distinct meanings, which don't all involve logarithms.

The *logit* function, used in logistic regression, is the natural logarithm of a probability (P, with a value between 0.0 and 1.0) divided by 1-P:

```
Logit(P) = ln[P/(1-P)]
```

The *lognormal* distribution is a distribution of values whose logarithms follow a Gaussian distribution. The lognormal distribution itself is asymmetrical with a heavy tail to the right. It is easy to be mislead by the asymmetry, and mistakenly eliminate values in the tail of the distribution as outliers.

The notation “log(x)” can be ambiguous

Within Prism transforms and equations, the log() function computes the common (base 10) logarithm.

With some computer languages (for example, Javascript) log(x) denotes a natural logarithm, not a common logarithm. Excel is especially confusing. In an Excel worksheet function, log(X) is the common logarithm, but in an Excel VBA macro, log(X) is the natural log.

The notation “ln(X)” is the natural logarithm in Prism.

Don't mix up logarithms with scientific notation

Consider the value 0.000000001. It can be written as 10-9. Since computer programs can't deal with subscripts, this is entered into most computer programs (including GraphPad Prism and Excel) as 1e-9. The 'e' here means "times ten to the power of". Don't mix up that scientific notation with a logarithm. The logarithm of 0.000000001 is -9.

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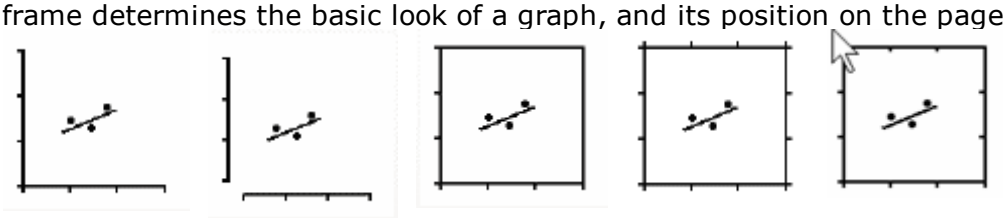
14.5.5 Frame and origin

The frame determines the basic look of a graph, and its position on the page.



Positioning a graph on the page 536

Customizing a graph's frame and axes appearance 537

Showing grid lines 539

Setting the graph origin 541

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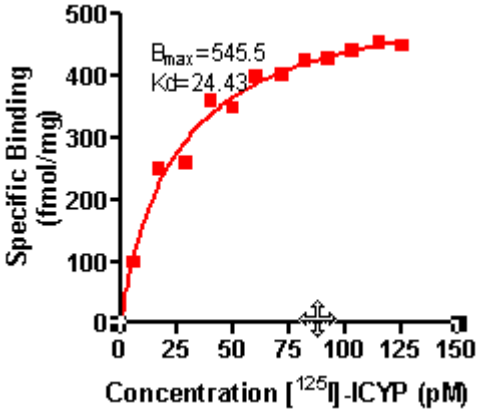
14.5.5.1 Positioning a graph on the page

If you plan to copy and paste the graph to another program, or place the graph on a Prism layout, you won't really care where it is on the page. But if you plan to print that page, you might care to position a graph precisely.

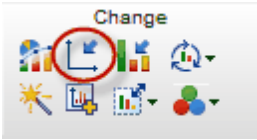
To see the position of a graph on the page: Drop the View menu, choose Zoom, and choose To Fit Page. This lets you see the entire page at once, so you can see the position of the graph relative to the entire page.

To center the graph on the page: Click on the Center on page button in the Arrange section of the Prism toolbar.

To drag a graph on the page: Grab either axis and drag the graph.



To specify an exact position on the page: Click on the Format Axis tool in the Prism toolbar and enter the exact distance of the graph from the top and left edge of the page in the Frame and Origin tab of the Format Axes dialog.



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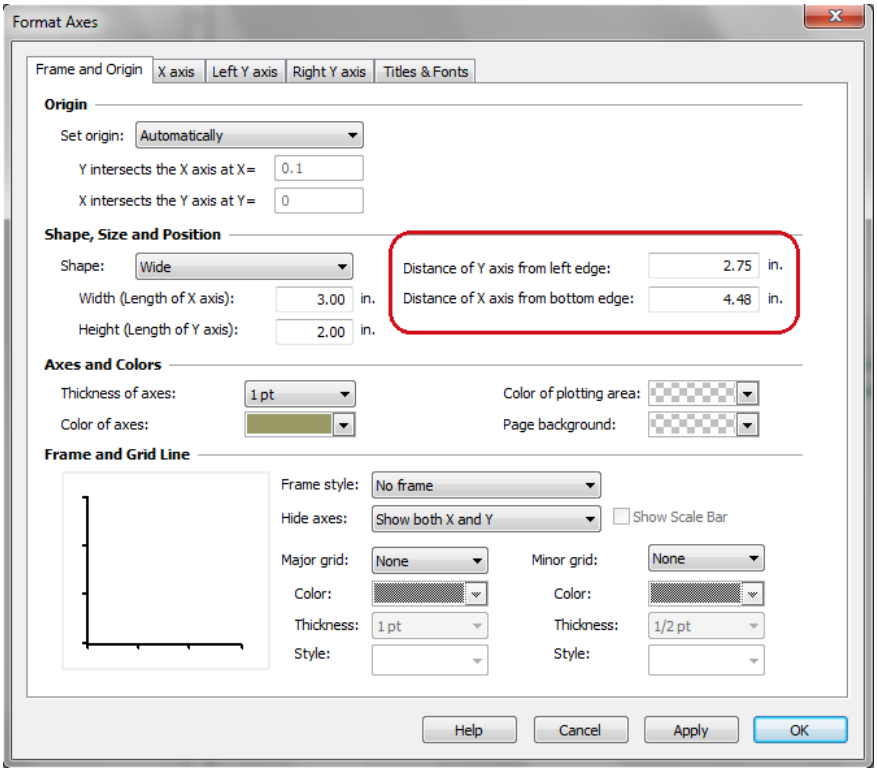

14.5.5.2 Customizing a graph's frame and axes appearance

Double-click on the graph origin to open the Frame and Origin tab of the Format Axes dialog.

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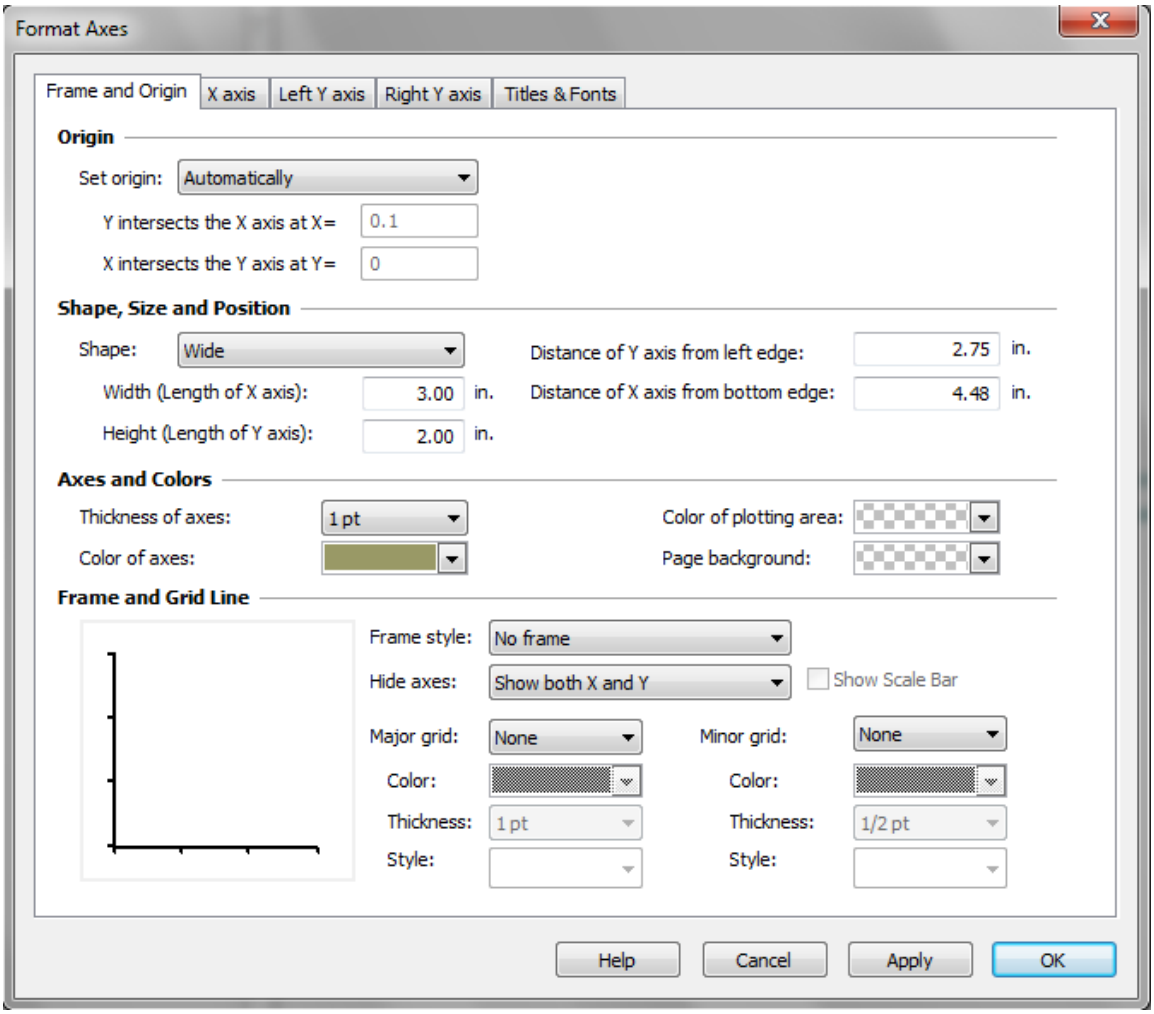
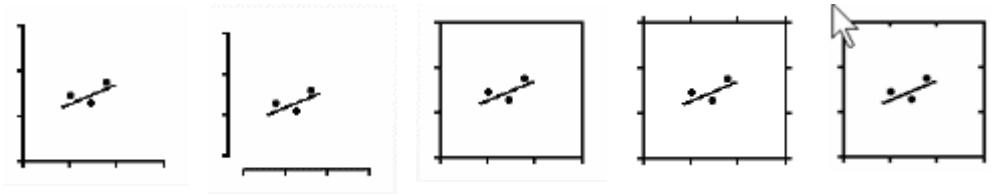


Use this dialog to set the origin of your graph and to format the color and shape of the axes or surrounding frame.



Notes:

- To change the gap of an offset axis, click and drag the end of the axis.

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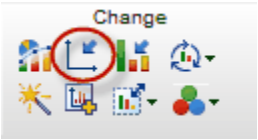
- To draw a box around a graph 564, including titles and numbering, use the drawing tool. Or wait until you assign a graph to a layout, and choose the border on the second tab of that dialog 551.

- To change the color or thickness of one axis. In rare cases, you may want to change the color or thickness of one axis and not the other(s). Or you may want to make one axis white (or whatever your page background color is) to make it essentially invisible. To do this, select the axis, drop the Change menu and choose Selected Object. Then change the color or thickness in the Format Object dialog.

14.5.5.3 Showing grid lines

Regular grid lines

Double-click on the graph origin to open the Frame and Origin tab of the Format Axes dialog. Or click on the Format Axis tool in the Prism toolbar.



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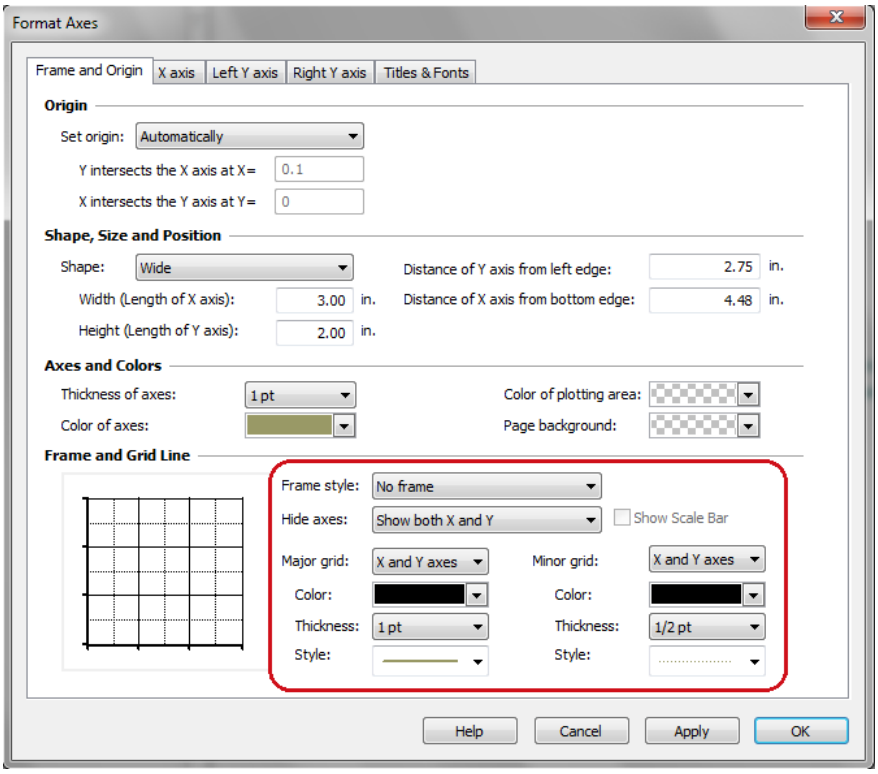

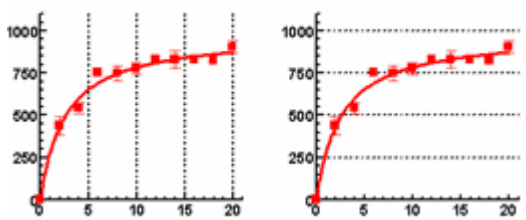

Note that grid lines from the Y axis always come from the left Y axis. Even if you turned off that axis, its major tick interval controls the grid lines. It is not possible to create automatic grid lines from the right Y axis. But you can place additional ticks or lines 503 one at a time to give the same effect.

Special grid lines

Double-click an axis and use the Format Axis tab to place additional ticks or lines 503 (formerly called Custom Ticks) on your graph. You can create as many grid lines anywhere on an axis.

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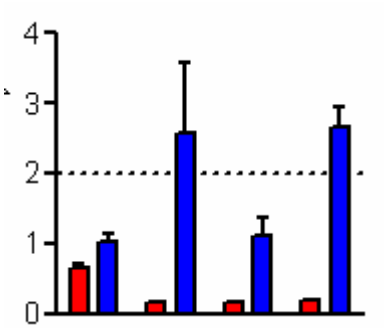
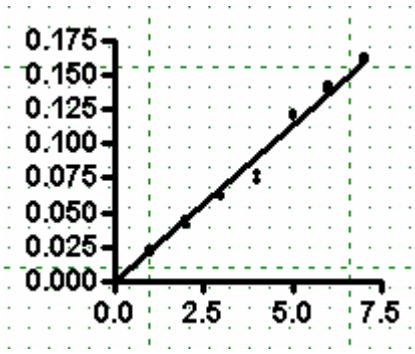


Using a grid to align objects

Right-click anywhere on the Prism toolbar and choose Show Grids, or drop the View menu and choose Show Grids. This grids will not show in printouts or exported images.



14.5.5.4 Setting the graph origin

The position where the X and Y axes intersect is called the "origin." To change the position of a graph's origin, double-click on the origin of a

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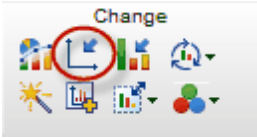
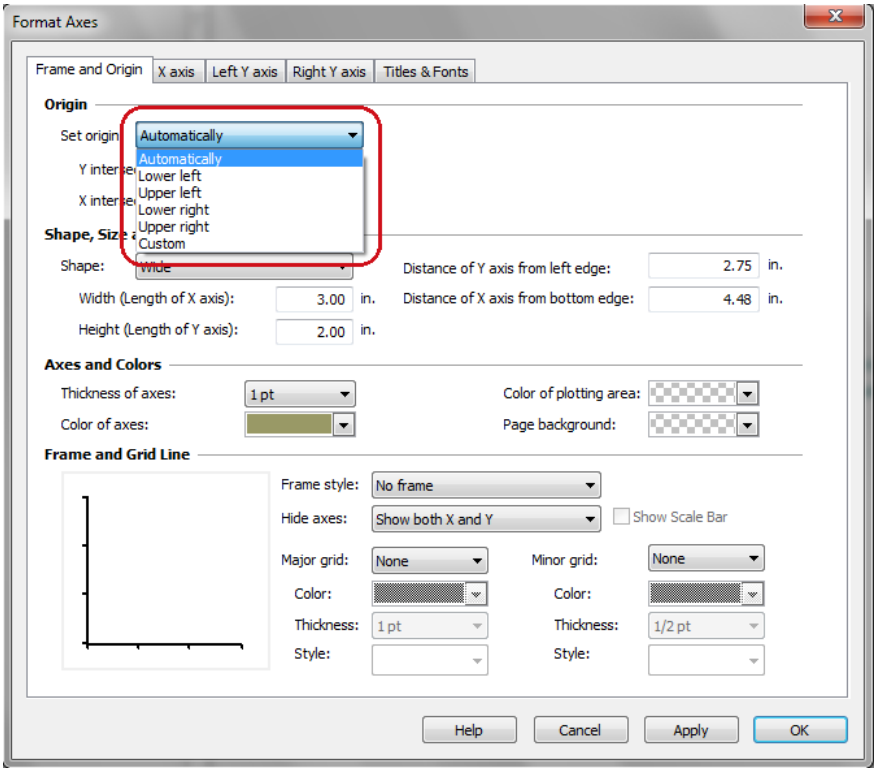
graph to open the Frame and Origin tab of the Format Axes dialog). Or click on the Format Axis tool in the Prism toolbar.





14.5.5.5 Graphs: Frame and axes

The choices on the Format Axis dialog are self-explanatory. Don't overlook the Additional Ticks and Grid lines section 503 which lets you place any numbers or labels anywhere on any axis. And don't overlook the Frame and Origin 537 tab.

Here is a list of shortcuts to change the axis directly, without using the Format Axes dialog:

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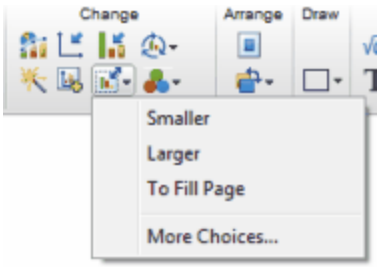
- To change the shape and size of a graph by stretching: Click once on an axis to select it. Then drag on either end to stretch.

- To make a graph proportionately larger or smaller: Click Resize Graph button on the Change section of the Prism toolbar.



- To change the thickness or color of one axis: Click once to select that axis. Then click Change and choose Selected Object(s). If you change the X axis, the top part of the axis frame will also change accordingly. If you change the left Y axis, the right part of the axis frame will also change accordingly (unless you created a right Y axis).

- To move the graph and axis titles closer to, or further from, the graph: Position the mouse near the title until the cursor becomes a two-headed arrow. Then drag.

- To move the axis numbering (or labeling) closer to, or further from, the axis: Move the mouse over the numbering until the cursor becomes a two-headed arrow. Then drag. Or click once on the numbering to select. Then nudge one pixel at a time by clicking the arrow keys.

- Double-click on the origin of a graph to bring up the Frame and Origin tab of this dialog.

- To format the size, font, color, etc. of the numbering of an axis, click to select the axis and then use the controls in the Text toolbar.

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15 Page layouts

Page layouts let you combine several graphs on a single page, along with data or results tables, text, drawings, and imported images. Graphs can be from one or several Prism projects.

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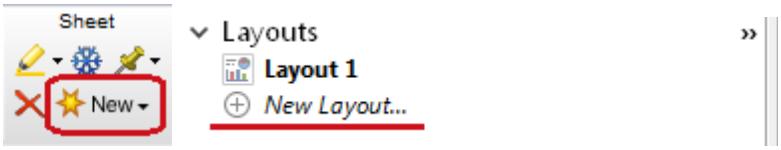
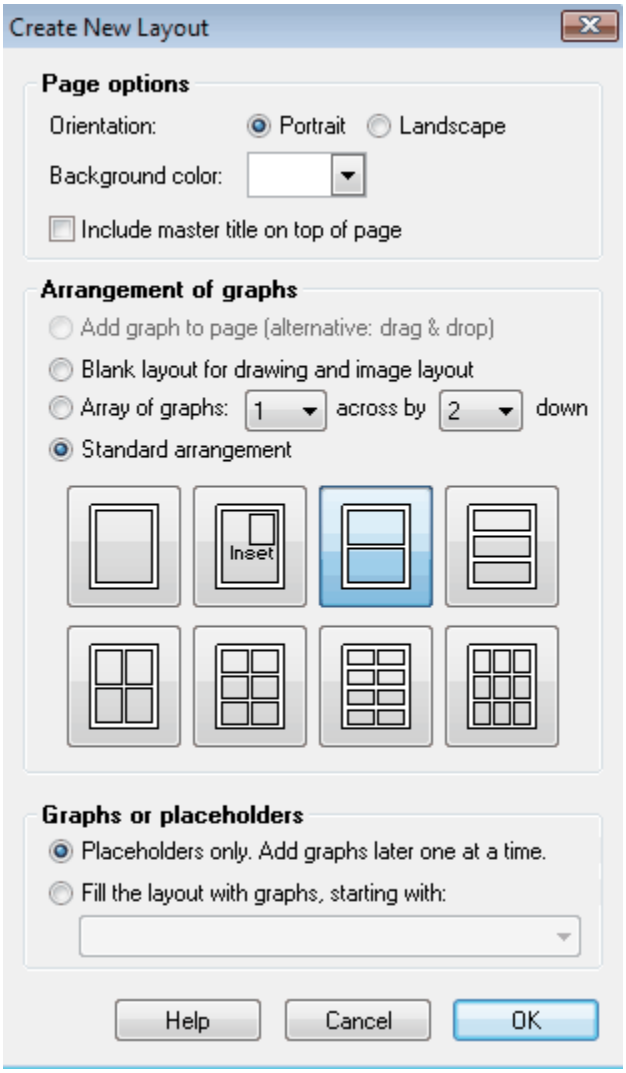
15.1 Creating a layout

Create a new layout

Click the New button on the toolbar, drop the Insert menu and choose New Layout, or choose New Layout in the navigator panel on the left.





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1. Choose whether you want portrait or landscape orientation for the overall page, and choose its background color.

2. Choose the number of placeholders you want on the page, and their arrangement.

3. Decide either to start with a layout page with placeholders only, or to automatically place graphs onto the layout. In the latter case, you specify the first graph and Prism places the other graphs automatically working in the order the graphs appear in the Graphs section of the navigator.

Change the arrangement of graphs on a layout, or add more placeholders

When you first create a layout page, Prism asks you to choose an arrangement of placeholders. But you are not stuck with this arrangement. You can always go back to the Format Layout dialog by clicking its toolbar button, or dropping Change and choosing Arrangement of graphs. You can then either choose a new layout arrangement or choose to add one more placeholder to the layout.

15.2 Placing a graph from the same project on a layout

Place a graph on a layout using a placeholder

The simplest way to add a graph to a layout is to double-click on a graph placeholder, and then choose a graph in the Place Graph in Layout dialog

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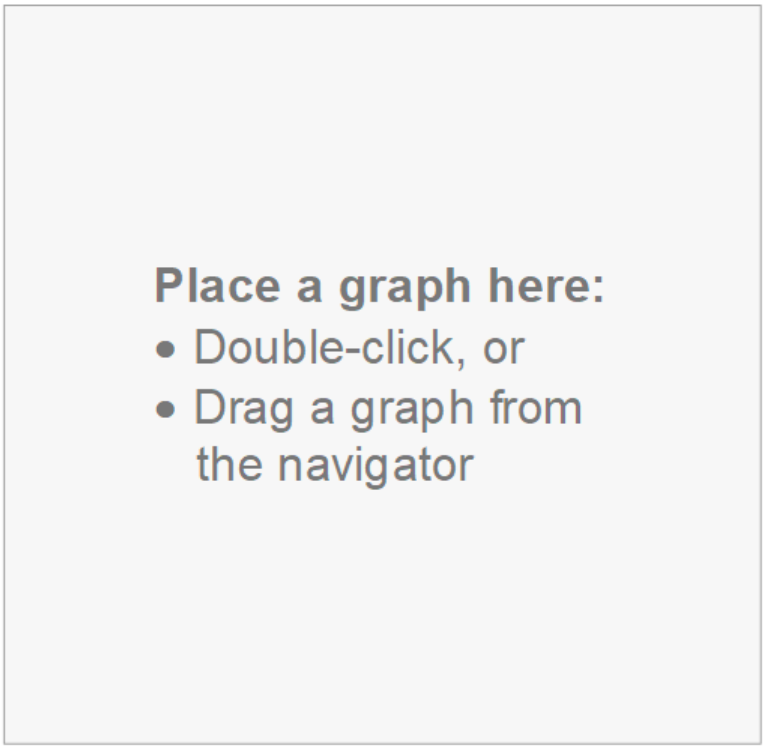

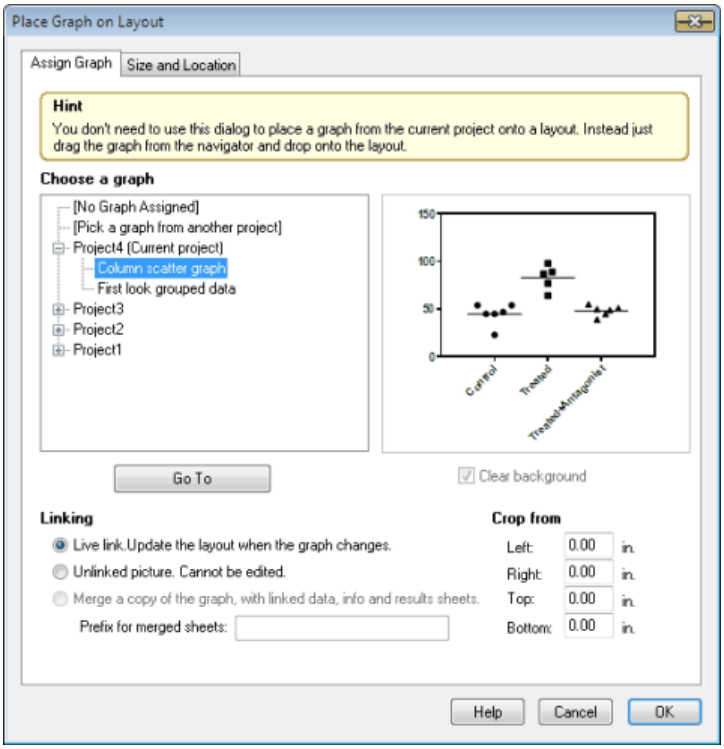

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Note that you can choose a graph from any project. It is especially easy to choose a graph from another open project. If you choose to Pick a graph from another project that is not open, after you choose that project file, Prism will open it.

Other ways to add graphs to the layout

- Drag a graph from the Navigator 146 and drop onto a blank spot on the layout page. Don't drop too close to an existing graph or you might end up replacing that graph rather than adding a new one.
- Go to the Graphs section of this project or any other, and copy a graph to the clipboard. Then go to the layout, and paste.
- From the layout, drop the Insert menu and choose Prism Graph. Then choose the graph you want to add to the layout.

What if you assigned the wrong graph?

If you assign the wrong graph to the layout, it is easy to replace. Just double-click on the wrong graph (in the layout) and choose its replacement. Or drag the name of the replacement graph from the Navigator and drop on top of the graph you want to replace.

15.3 Placing a graph from another project on a layout

You can place a graph from a different project file from within the Place Graph in Layout dialog. Or you can copy the graph in one project and paste into another.

If you choose or paste a graph from another project, Prism offers three choices.

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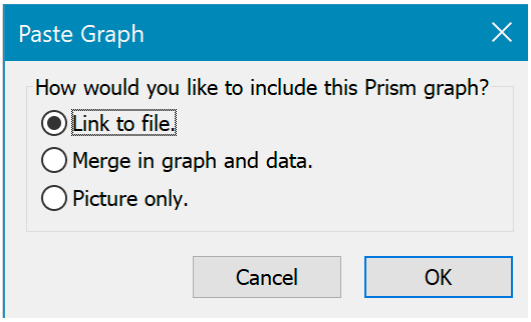

Link to file

The graph in the layout will be linked to the graph in the other file. The advantage of linking (which some will consider to be a disadvantage) is that the data and graph only exist in one place.

The link is by file name and location. Prism can maintain the link only if the name and location of the linked file doesn't change If you rename the file, move it to a different folder, or work on the file with the layout on another computer, you will break the link.

To edit a linked graph, you'll need to go to the original project.

To force an update to the graph in the layout, save the file that includes the graph and data. Then when you go to the graph with the layout, the graph will update. If you use Prism Mac, it is enough to move to a different sheet in the project with the data and graph. But this works only if you have set the preferences in the File & Printer tab to save a backup whenever you switch to a new sheet. In this case, you don't need to save the file for the layout to update.

Merge in graph and data

Merge a copy of the graph, along with its data tables and analyses, into the project you are working on now.

The advantage of this approach is that everything will be in one project. This means the file is self-contained. Even if you move it to a different computer, everything will work.

The disadvantage (which some consider to be an advantage) is that the data will now exist in two files.

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Unlinked picture

As the name suggests, this is just a picture that is not linked to any data or any editable graph.

15.4 Adding another graph to the layout

When you first create a layout page, Prism asks you to choose an arrangement of placeholders. But you are not stuck with this arrangement. You can always go back to the Format Layout dialog by clicking its toolbar button, or dropping Change and choosing Arrangement of graphs.

If you assign the wrong graph to the layout, it is easy to replace. Just double-click on that graph (in the layout) and choose its replacement. Or drag the name of the replacement graph from the Navigator and drop on to the graph you want to replace.

It is easy to add a new graph to the layout. First resize and move graphs to make space for a new one. Then do any of the following (the first two choices are the simplest).

- Drag a graph from the Navigator 146 and drop onto a blank spot on the layout page. Don't drop too close to an existing graph or you might end up replacing that graph rather than adding a new one.

- Go to the Graphs section of this project or any other, and copy a graph to the clipboard. Then go to the layout, and paste.

- From the layout, drop the Insert menu and choose Prism Graph. Then choose the graph you want to add to the layout.

- From the layout, bring up the Format Layout dialog (by clicking its toolbar button, or dropping Change and choosing Arrangement of graphs) and choosing to add another graph to the layout.

15.5 Making a graph an unlinked picture

By default, Prism the graph on the layout automatically updates when the graph itself updates.

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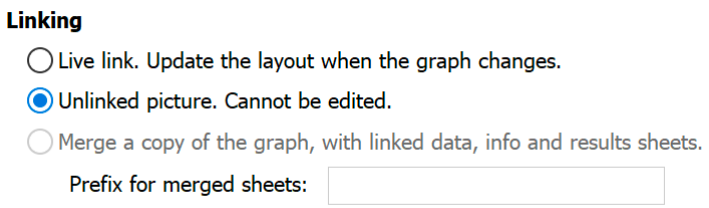
You can choose to place the graph on the layout as an unlinked picture with no link to the original data. You might prefer this option if you are sure the graph is 100% done, and you don't want to allow any possibility of it being changed. It can also be useful if you want to keep "snapshots" of a graph as a project continues and additional data are collected and graphed.

The choice to make a graph an unlinked picture is on the lower left corner of the Assign Graph to Layout dialog.



15.6 The size of graphs on layouts

What is the scaling factor?

The *scaling factor* is defined as the ratio of the size of the graph on the layout compared to its size on the graph.

If the graph and layout are zoomed 155 differently, it will be hard to understand the scaling factor. Set the zoom to be the same for the graph and layout (using controls in the lower right of the Prism Window).

Changing the scaling factor of one graph

The easiest way to change the scaling factor is to select a graph on a layout page, grab a corner knob and drag.

If you want to set the scaling factor to a particular value, double click on the graph (on the layout) to bring up the Place Graph on Layout dialog. Go to the second (Size and Location) tab, and set the Scaling Factor.

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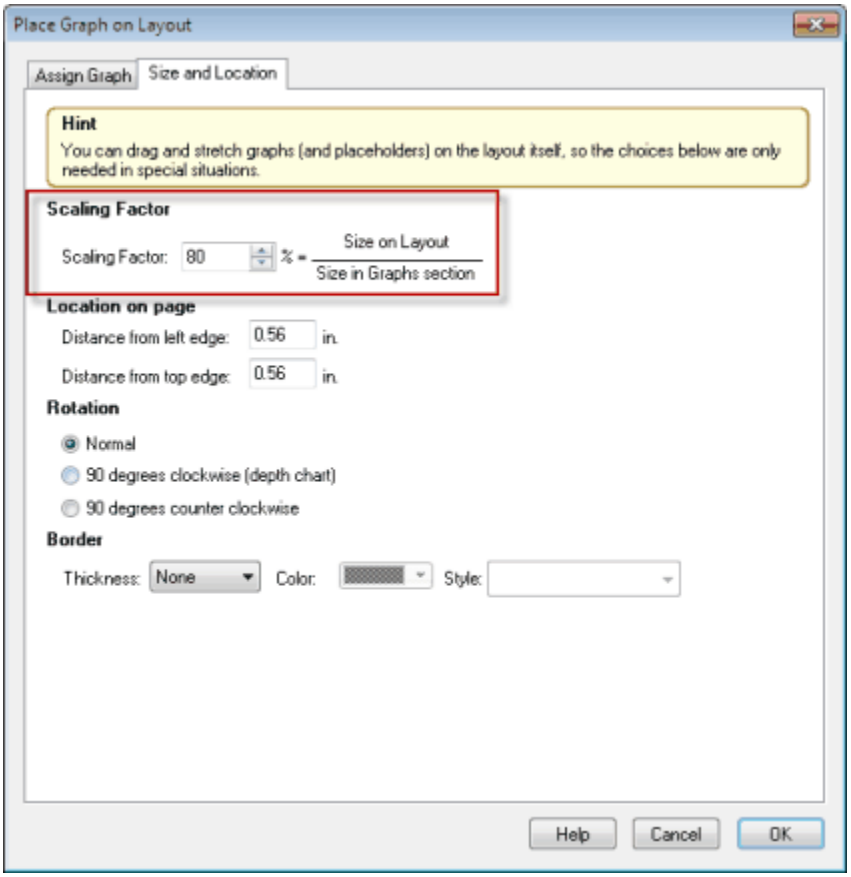

Note that this tab also lets you specify a border to go around the graph.

Equalize the scaling factor of several graphs

1. Select the graphs to equalize (not necessary if you want to equalize all graphs on the layout).

2. Choose Equalize Scaling Factor from the Arrange menu, or press the button in the Change section of the toolbar.

3. Choose to reduce the scaling factor of graphs that are larger than the others, or to increase the scaling factor of those that are too small. If graphs were originally made the same size, with same size fonts, this command will get things the same again on layout. If graphs started off with different sizes, however, this command won't be very helpful.

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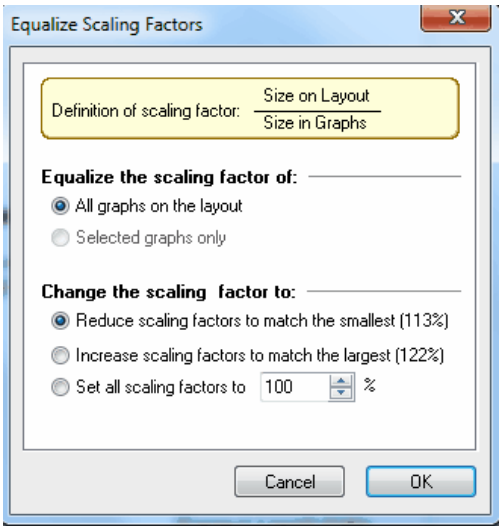
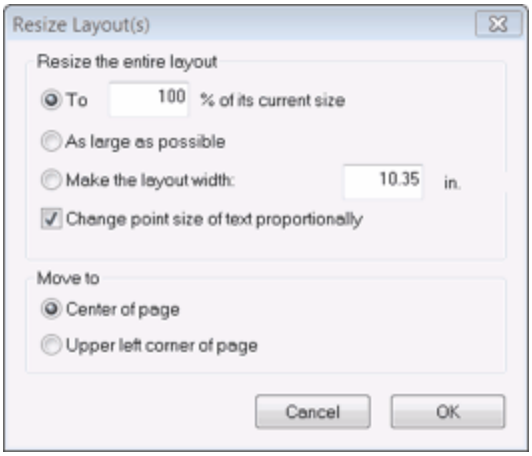


Increase or decrease the scaling factor of all graphs

1. Choose Resize Layout from the Change menu, or click the Resize button.

2. You'll see a menu with choices: Smaller, Larger, To Fill Page, or More Choices (which brings up the dialog shown below).



Cropping

The first tab of the Assign Graph graph dialog lets you crop a graph to get rid of white space or portions of the graph you don't want to see on the layout. If you enter a negative value for any of the cropping values, you'll make the graph placeholder larger, adding white space in that direction.

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15.7 Creating a depth chart

A depth chart is an XY plot rotated so the independent X variable is shown on the vertical axis, and the dependent Y variable is shown on the horizontal axis. This makes sense when the X variable is depth. Follow these steps:

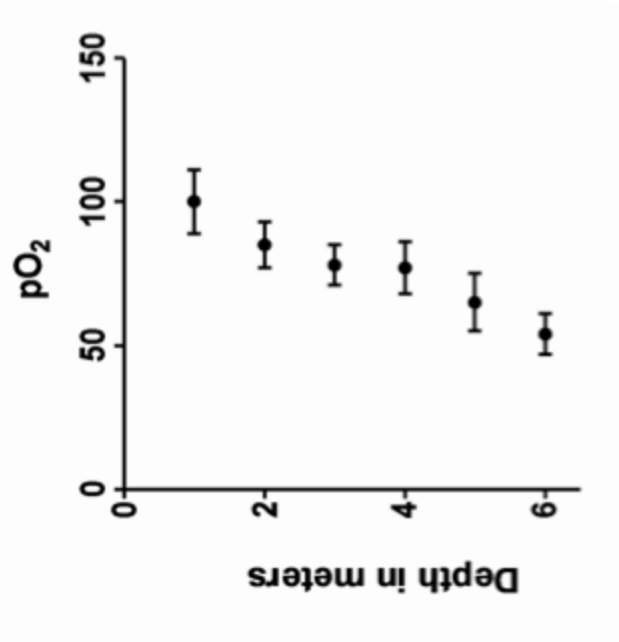
1. Enter data on an XY table. Enter the depth values into the X column.

2. Prism will create an XY graph with X on the horizontal axis.

3. Use the Format Axis dialog to change the direction of the numbering on both axes. Set the X axis numbering to: Below, vertical. Set the Y axis numbering to: Left vertical.

4. Delete the automatic X axis title (because it cannot be rotated).

5. Create an independent text object with the depth title. Select it, and rotate 180 degrees by clicking the rotate button in the lower right of the Text area in the toolbar several times.Your graph will now look like this:



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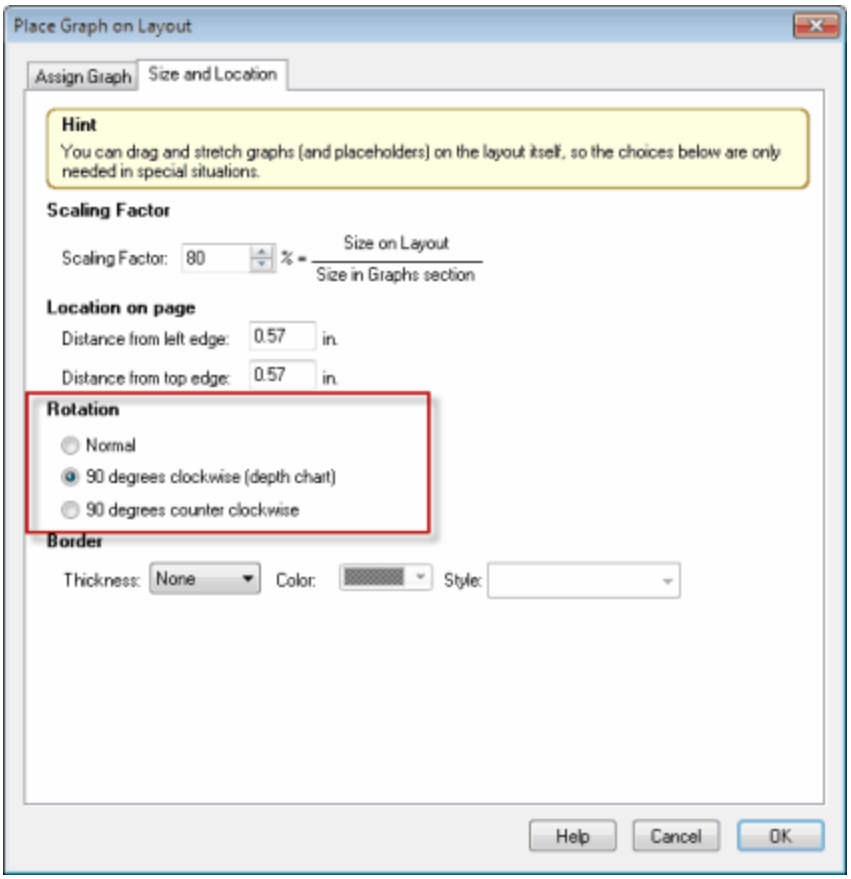
6. Assign that graph to a layout.

7. Double click on the graph to bring up the "Place graph on layout" dialog. Go to the second (Size and Location) tab, and choose to rotate 90 degrees clockwise.



The result, on the layout, is a depth chart, with the X variable on the vertical axis and the Y variable (and its error bars) plotted on the horizontal axis.

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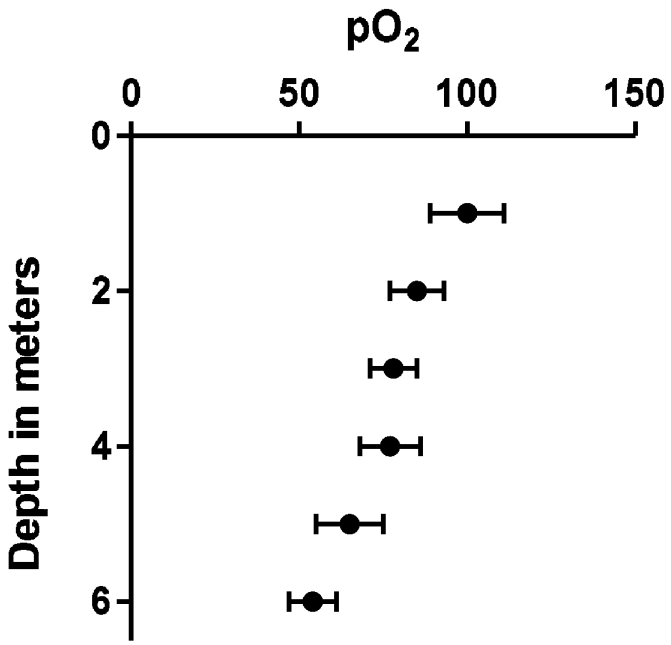
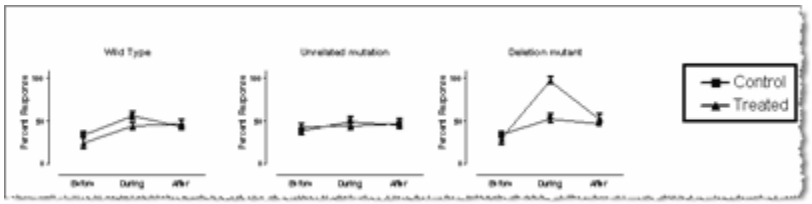


15.8 Master legends (one legend for several graphs)

If you place several graphs on a layout, you can create a master legend that applies to all the graphs as shown below.



A master legend is one legend on a layout that is for several graphs. To create a master legend, create an extra graph (not on the layout) with the legend you want. Then select and copy that legend and paste to the layout. Then add other graphs without legends to the layout.

It took four graphs to make the figure above. The first three graphs show data, and the fourth (not shown) was used only to create the master legend. Follow these steps:

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1. Duplicate one of the graphs to create another graph that won't be shown in the layout, but will be used to create a legend. To create a legend on this graph, double-click on a symbol to bring up the Format Graph dialog. Click the 'Global' button, select 'Change all data sets' in drop-down. You can also select 'Change ALL data sets' from 'Data set' drop-down.

2. Create a layout and assign the graphs (three in this example).

3. Select and copy the legends from the extra graph and paste onto the layout (Paste Drawing). That is a simple copy and paste operation and does not use a placeholder.

Notes:

- The master legend is linked to the graph from which it was copied. If you change the symbols in that graph, Prism will update the master legend.

- Master legends on a layout have exactly the same size as the legend on the graph from which you copied the legends. When you place graphs on layouts, you can shrink or expand it to fill a placeholder. You can't do this with master legends. The only way to change the size of the symbol in the master legend is to change the font size and symbol size on the graph used to create the master legend. This is done in the graphs section, not the page layout section.

- You can edit the text of the legend, change the size of the text in the master legend, and make it bold or italics. These changes will be lost if you make any changes to the graph from to which the master legend is linked.

- After copying a legend, you can only paste it into a layout. It is not possible to paste a legend onto another graph.

- It doesn't work well to copy a legend from a graph in one project and paste onto a layout of another. Set things up so the copy and paste is all within one file.

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15.9 Duplicating a layout

If you have a page layout whose arrangement you like, duplicate it (just the sheet). Then double-click on each graph to bring up a dialog where you can choose a different graph for that slot.

Prism offers a direct way to clone a graph from the Welcome (File..New) dialog, but does not allow cloning of layouts. However, you can accomplish the same goal by going to a layout, dropping the New button, and choosing to Duplicate Family. This will duplicate not only the layout, but all graphs on the layout and all results and data sheets linked to those graphs. Edit all the data tables, and you are done. The analyses and graphs will automatically update.

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16 Adding text, drawings, results and pictures to graphs or layouts

This section explains how to add text, drawings and pictures to a graph or layout.

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16.1 Adding text

Adding text to a Prism graph or layout

To enter new text anywhere on a graph or layout:

Click one of the text 'T' tool buttons (the one on the right makes a text box with a border).

Click on the graph or layout at the spot where you want to enter text and type. If you want to enter several lines, press Enter between lines. When you are finished, click to select another tool or somewhere else on the page.

To enter a paragraph with automatic word wrapping:

Enter the first line or two using one of the text tool buttons and then click anywhere else on the page to create the text object. Go back and click on your text. You'll see knobs on the corners. Drag the knobs to make the text object the correct width. Don't worry about the height, as it will grow automatically as you enter text. Now, double-click inside the text object to bring back the insertion point and type your text. Don't push Enter at the end of each line, as Prism will automatically wrap the text as you type.

To add Greek letters, European characters, math symbols or Wingdings:

First be sure you have a text insertion point. Then press the Greek button and choose a character from the menus provided.

Tech details: Within Prism, Greek characters are encoded by switching to the Symbol font, and this is also true when you export a graph that encodes fonts (pdf, eps, wmf, emf). However, if you copy text to the clipboard, the Greek is encoded as Unicode characters, so there is no need to switch to Greek font.

To add a constant from an Info table:

You can add a constant from an Info sheet 185 in a text box. Use the Insert Info Constant button on the Write section of the Prism toolbar. Once

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you've added an Info constant to your graph or layout, double click to open the text box and add a label. If you edit the Info constant, the linked text-box on your graph will be updated.

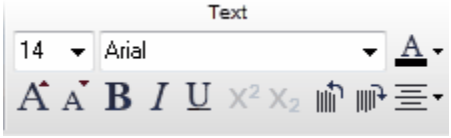
To enter en or em dashses:

An en-dash is wider than a hyphen or minus sign. An em-dash is even wider. Learn how to enter these in Prism.

Changing text

To change font and size of text:

Standard toolbar buttons let you make text bold, italicized, underlined, subscripted, or superscripted, and let you change font, color, and size.



Select a block of text or an entire text object and use the right-click menu. Or pull down the Change menu and choose Selected Text to bring up the font dialog.

GraphPad does not provide any fonts with Prism, but lets you choose any TrueType font already installed in your system. If you want a font that is not in the list, you'll need to find or buy the TrueType font and then install it into Windows or Mac OS X.

To rotate text:

You can rotate text objects to any angle you want. Click on one of the text-rotation buttons in the Text section of the Prism toolbar. The buttons will rotate your text in 15 degree increments.

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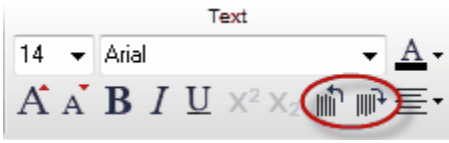
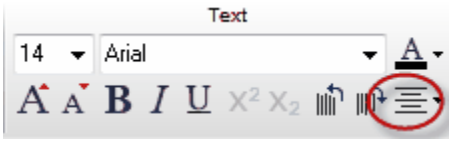


Or double-click on the object boundary to bring up the Format Text dialog. Then set a standard rotation (horizontal, vertical up, vertical down) or choose angled and enter the rotation angle in degrees.

To change the alignment of a text block:



Click on the Justify button on the Font toolbar. From the drop-down menu, you can choose, right-justified, left-justified, or centered. Whichever you choose will be the default the next time you enter text.

To add or change a border or background:

Right click on a text block, and you'll see choices to change the border thickness and color, and the background. Or double-click on the border of the text object to bring up the Format Text dialog. Then click the Border and Fill button to bring up a dialog where you can change border and background.

To move text:

Move a text object by dragging. You can also stretch the object to change its shape. This will change how text wraps, but will not change the point size of the lettering.

You can only move axis and graph titles closer to, or further from, the graph. They always remain centered. To move a title closer to or further from the graph, point the mouse near the title until the cursor changes to a two-headed arrow. Then drag the title.

You can also move axis numbering (or labeling for bar or category graphs) closer to, or further from, the axis. Click on the numbering to select. Then use the arrow keys to nudge its position. Or set the distance between numbers and axis within the Format Axis 494 dialog.

To prevent text from snapping into alignment:

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When you drag a text object around the page, it will automatically snap into alignment with other text objects, with the center of bars (etc.) on graphs, or with the center of a graph. You can keep dragging, so are not trapped by the snapping. If the snapping gets in the way of moving the text object where you want it, hold down the ALT key while dragging and there will be no snapping.

16.2 Using Word to add text (Windows only)

You can use Microsoft Word® to add text to a Prism graph or layout. Word gives you more formatting options than are possible with Prism text tools. You can create bulleted lists, add tables -- anything you can do with Word. It's a bit more cumbersome, however, because you must open Word in a separate window to edit your text, rather than editing it directly on your Prism sheet. This is most often helpful when you have large text boxes that require a lot of formatting.

To add text to a graph or layout using Word, click the Word button in the Write section of the Prism toolbar. This will open Word so you can create your text box. To finish, click on Update in Word File menu, or simply close Word.

To edit a Word text box in Prism, double click on the text in Prism. This will open Word. To finish, click on Update in Word File menu, or simply close Word.

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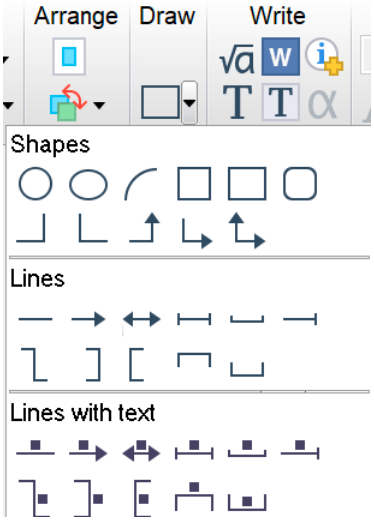
16.3 Drawing lines, arrows, and shapes

Drawing lines, arrows, and other shapes on a graph

1. Click on the drawing tool in the Drawing toolbar. If you want to draw several objects, hold Shift while selecting the drawing tool. Then you'll be able to use it repeatedly without selecting it again. Click any other Toolbar button to unselect the drawing tool. The tool you used most recently will show as the default drawing button on the main Prism toolbar.



2. Position the mouse pointer (now a pencil) at one end of the line or arrow (or one corner of the box or oval).

3. Hold down the primary mouse button and drag to the other end (or to the diagonally opposite corner). Hold the control key if you want to draw a perfect circle or square.

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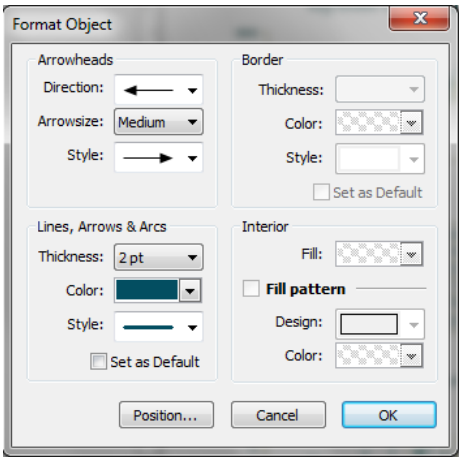
4. If you chose a line (or bracket) with text, click in the insertion point over the line to enter centered text.

Changing the appearance of a drawing object (line, arrow, square, etc.)

Select any object and double-click on it to bring up the Format Object dialog. Choose the thickness, color, and style of lines or borders; the fill color and shading of shapes; and arrowhead direction, size, and style.

For a line, for example, you can choose to have no arrowheads, or arrowheads on one or both ends. You can also choose to caps on the ends of a line instead or arrows.



You also can right-click on any drawing object to change individual properties like color and line thickness.

Changing the default line color or thickness

Draw a line, then double click to bring up the dialog above. Change the thickness, color and style to what you want the default to be for future lines and arrows. Check the option "Set as default" and OK from the dialog. Now those settings will be used when you draw new lines or arrows.

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16.4 Including pictures and other objects

Pasting or importing images

You can paste or import picture onto a Prism graph or layout.

OLE

Windows only: When you paste an object created by a program that is an OLE server, Prism will embed the object. This means that Prism contains a separate copy of the object, so you can double click to edit in the original program. This is great, for example, with equations. In some cases, you may prefer to paste link to the original file. To do that, copy the object and then choose Paste Special from the Edit menu. Then choose Paste Link. To learn more about the pros and cons of linking and embedding, see Object linking and embedding 270. You can also use the Insert Object command to create a new OLE object.

Formats Prism can paste or import

Prism Windows can import:

Windows Enhanced Metafile (*.emf)
Windows Metafile (*.wmf)
TIFF (*.tif;*.tiff; bot extensions are used for exactly the same file type)
JPEG (*.jpg;*.jp2;*.j2k;*.jpx)
Portable Network Graphics (*.png;*.mng)
Windows Bitmap (*.bmp)
Graphics Interchange Format (*.gif)
PC PaintBrush (*.pcx)
TruvisionTarga Format (*.tga)
Microsoft Paint Format (*.msp)
PhotoShop 3.0 Format (*.psd)
Windows Icon and Cursor Formats (*.ico)
Portable document format (*.pdf)

Prism Mac can import:

TIFF (*.tif;*.tiff)
Windows Bitmap (*.bmp)
JPEG (*.jpg;*.jp2;*.j2k;*.jpx)

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Macintosh Pict (*.pct;*.pict)
Portable Network Graphics (*.png)
Portable document format (*.pdf)

If your image uses a 16 bit color model (millions of colors), Prism (Windows and Mac) stores the image as such and does not simplify it.

Editing the picture in Prism

To resize: Grab a corner and drag larger or smaller.

To add a border or crop: Click once to select the image or object in Prism. Then drop the Change menu and choose Selected Object. You can also double-click on the object.

Problems with windows/mac compatibility

We try to keep Windows and Mac completely compatible. Since version 7, Prism Windows keeps a copy of each image in a Windows format (EMF, WMF) also in pdf for Prism Mac to use. Prism files created with older versions of Prism Windows may lose pasted/imported images when opened on Prism Mac.

16.5 Tips for moving or rotating objects

Selecting objects on the page

When you work in the Graphs 391 section of your project, the graph itself as well as text, legends, drawings, and imported images are all referred to as "objects". When you are working in the Layout section 544 of your project, each graph with all of its objects is grouped into a single object. Images imported onto a page layout are also objects. Images imported onto a graph are objects in the graph section, but are part of the graph object in the page layout section.

To select one object:

Point to the object and click the left mouse button. To select a rectangle or oval, click on its edge. Prism displays knobs on the selected object.

To select several objects:

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Hold down the Shift key while selecting the objects one at a time. Or… drag an imaginary rectangle around all the objects. You've selected all objects entirely contained within the rectangle.

Moving objects

To move an object with the mouse:

Point to an edge. Press the left mouse button and drag.

To move an object vertically or horizontally only:

With Prism Windows:

Hold the Shift key while dragging to allow only vertical movement. (Remember this because the Shift key is marked with a vertical arrow.)

Hold the Ctrl key while dragging to allow only horizontal movement.

With Prism Mac:

Hold the Shift key. Prism will let you drag vertically or horizontally, but not at an angle.

To prevent automatic snapping:

Hold the ALT key down while dragging an object to prevent Prism from trying to automatically snap it into place.

To nudge an object a tiny distance:

Select one or more objects. Press the up, down, right or left arrow keys. Each press of an arrow key moves the object(s) one pixel.

To nudge an object in larger steps:

Hold down the Control key (Windows) or Command key (Mac) and each click of an arrow key will move the objects in larger steps.

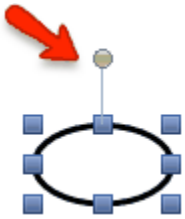
To group two or more objects so they move together:

Select Group from the Arrange menu or toolbar.

The set of objects now acts as a single object. If you want to work with the individual objects again, drop the Arrange menu and choose Ungroup.

To rotate an object:

Grab the rotation knob and move your mouse.



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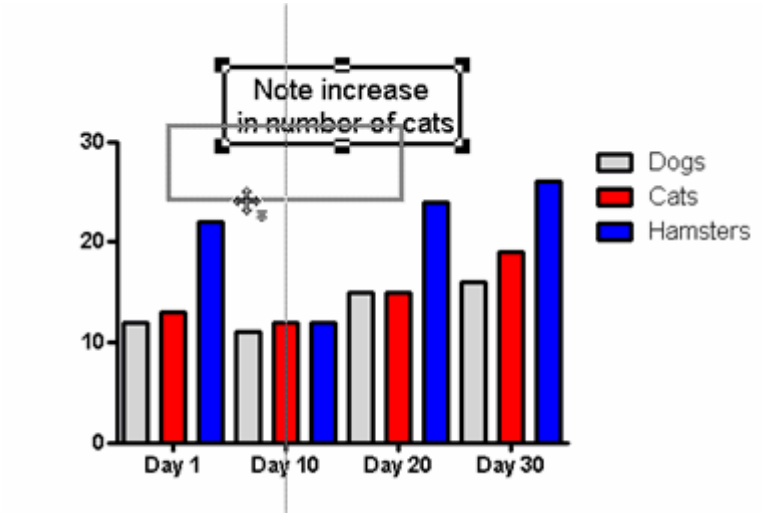
16.6 Aligning objects on a graph

Automatic snapping

Prism will automatically try to snap objects to be in alignment with graph axes and other objects. For instance, you can drag a text box over a bar or group of bars and Prism will try to snap the text box to align with the centerline of the bar. Prism will also change the justification of the text to "centered." If you don't like this, you can change the justification back using the text justification button in the Text toolbar.

To overcome this automatic snapping, hold down the ALT (Windows) or Command (Mac) key while dragging the object.



Using the Align or Group button in the Arrange section of the Prism toolbar

For graphs, use the drop-down menu under the Arrange button

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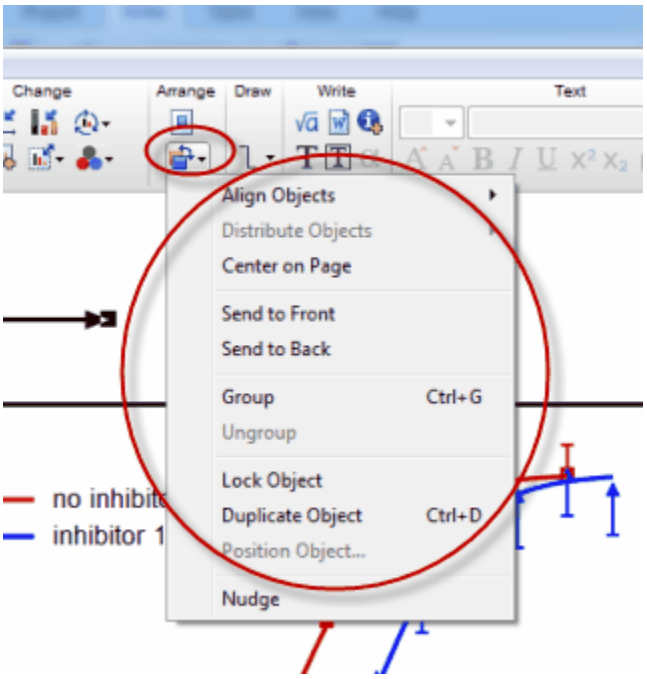

For layouts, each task has its own button in the Arrange toolbar.

To align objects:

- Select Align Objects from the Arrange menu or toolbar. Choose horizontal and vertical orientation, or to align by the X or Y axes.

To position an object by entering distances:

Select Position Object from the Arrange menu or toolbar. Enter the distance between the upper left corner and the top and left edge of the page.

To lock an object so you can't accidentally move it:

- Select Lock Object from the Arrange menu or toolbar. When you select a locked object, the knobs will be gray rather than black, and you will not be able to move the object or change its size. To unlock the object, select it, then select Lock Object from the Arrange menu again.

To bring an object on top of overlapping objects.

- Select it, drop the Arrange menu or toolbar and choose Bring to Front. Or use the toolbar button.

To send an object behind overlapping objects.

- Select the object. Drop the Arrange menu or toolbar and choose Send to Back. Or use the toolbar button.

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To space objects equally:

- Select three or more objects. Choose Distribute Objects from the Arrange menu or toolbar.

To duplicate one or more objects.

Select the object(s). Drop the Arrange menu or toolbar and choose Duplicate Object.

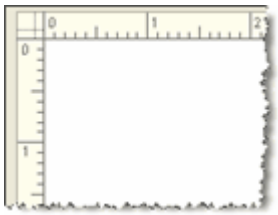
To center everything on a page.

- Click the Center button.

Zoom settings

To precisely align objects, zoom to a larger magnification. Select a zoom level in the View menu or click the zoom buttons. Zooming changes the magnification on the screen, but does not change the size of the graph or layout when printed. Hold Ctrl and press M to zoom larger or J to zoom smaller.

Rulers



Choose Rulers from the View menu. The rulers appear on top and to the left of the graph and page layout screens. Show the rulers to align objects precisely. Hide the rulers to leave more space for the graph.

Alignment guides

Alignment guides are temporary lines you can drop from the ruler to check on the position and alignment of objects. Click the mouse in either ruler to drop a single guide (down from the top ruler, or over from the left ruler). Click the corner where the two rulers intersect to drop both alignment guides at once. The guides will remain visible only as long as you hold down the mouse button.

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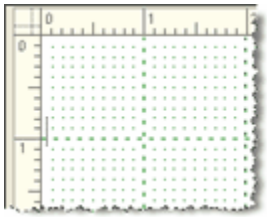
Grids



Choose Grids from the View menu. Prism will show a grid that extends from the minor ticks on the rulers, spaced every 0.1 inches, or 1 millimeter. This grid is provided to help you align objects. It will not print. Select Grids from the View menu again to turn it off. Note the distinction between showing this grid, and choosing a frame with a grid (from the Format Axes dialog) to include a grid on a graph.

16.7 Adding analaysis results to a graph

You can put analysis results on the graph easily.

1. Select a cell or a range of cells on a results table (or data table).
2. Copy to the clipboard.
3. Go to a graph and layout and paste.
4. Double click to reformat.

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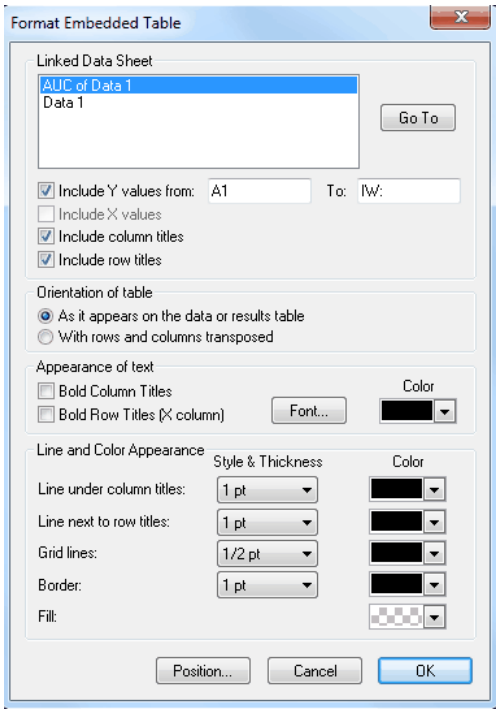

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17 Exporting images from Prism

There are several ways to get your graphs and layouts into other applications. You can export them to PowerPoint or Word using one-click export 592. You can export them in a variety of

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image formats, or you can copy and paste your graphs and layouts as bitmaps.

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17.1 How to export one or more graphs or layouts

Are you sure you want to export?

If your goal is to send graphs to a colleague who doesn't own Prism, consider sending a Prism file. He or she can then open the file using Prism itself, or the free Prism trial (which expires in 30 days but then becomes a free Prism viewer that never expires).

If your goal is to place graphs into a Word document or PowerPoint presentation, you can copy-and-paste or use the one-click send buttons rather than exporting. There are some settings in the File & Printer tab of the Edit/Preferences dialog that will affect the result and whether or not you will paste your graph as a Prism object or a picture.

How to export

1. Start from one graph or a layout, or from several graphs or layouts selected on the Gallery 182.

2. Click the Export button on the Prism toolbar to bring up the Export Graph dialog. Alternatively, drop the File menu and choose Export. You can also use the Send-to-PowerPoint or Send-to-Word buttons. Or the Print button.

3. Choose the export format 579, and also choose the location and name of the exported file.

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17.2 Exporting options

Export one graph or layout, or several or many?

To export several graphs at once, start from the graph gallery, select two or more graphs, and then choose to export. With most formats, each graph or layout will be exported to its own file. With PDF format, you can choose to export each to its own file or all to one file.

File format

This is the most important choice. If you don't want to think about it, we suggest using PDF if you can, and use TIFF as a second choice.

Read about the pros and cons of the alternative formats 579.

Clear (transparent) background?

Within Prism, there is no distinction between having a clear page background 590 and a white background. When you paste or export a Prism graph into another program, however, the two are distinct if the exported graph is combined with other objects that are behind (in a front-to-back sense) it. If the background is clear, you'll see other objects that are behind it. If the background is white, you won't.

The TIF, PNG, PDF, WMF (Windows only) and EMF (Windows only) formats allow you to choose a transparent (clear) background. With Prism Mac, but not Prism Windows, you can choose a clear background with EPS export. If you choose to export as a TIF file with a clear background from Prism Windows, it will be RGB 32 bits (with no choice of color model). The .JPG, and BMP formats simply have no concept of a clear background, so those file formats simply don't allow for the possibility of clear backgrounds.

Resolution

The resolution is entered in dots per inch (dpi). For perspective, most computer screens have a resolution of about 100 dpi, and most professional printing presses (used by journals) use a resolution of 1200 dpi. Laser printers range from 300 to 1200 dpi.

The PDF, EPS, WMF (Windows only) and EMF (Windows only) formats encode vectors and fonts, so have essentially infinite resolution. If you

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export in one of these formats, you will not be asked to enter a resolution. The other formats offer choices of 100, 300, 600, and 1200 dpi.

If you double the dpi, note that you quadruple the number of pixels in the image, and thus quadruple the file size.

Color model

If you choose the PDF, EPS or TIF format, you'll need to choose between RGB and CMYK color models 586. We recommend that you choose RGB when possible, as there will be fewer surprises. RGB colors will closely match what you see on the Prism screen (which internally uses RGB). Select CMYK only when submitting images to a journal that insists on CMYK.

With some formats, you can also choose between being able to save thousands (8 bit) or millions (24 bit) of distinct colors. When you choose thousands of color, some colors may get changed a bit when saved. When you save RGB, thousands of colors are stored in an indexed format, but millions of colors are not. Some journals may specify whether they want colors expressed in 8 or 24 bits, and whether they prefer indexed or nonindexed colors.

When exporting in jpg, tiff, pdf or eps formats, instead of exporting in color, you can choose grayscale where colors are converted to various shades of gray. With tiff, you can also choose monochrome (black and white with no grays).

Size

In most cases, you'll want to export without changing the size of the graph or layout. But you can specify the width of the exported graph. Don't enter the desired width of the graph's plotting area, but rather the desired width of the entire graph object, including any legends or drawings or objects.

The size you specify is the final size (width) of the exported object. If you choose "actual" size, then the size of the graphs in the exported file are the same as in Prism. What is the size of an exported image? It can depend on the program used to view it, so it helps to think about number of pixels instead (for the bitmap format). If you choose 300 dots per inch, and a graph is 4 inches wide and you choose actual size, then it will be 1200 dots wide in the exported file.

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Note that "actual size" doesn't refer to the size of the page the graph or layout is on. Prism ignores the size of the page when it exports. It exports the portion of the page that contains graphs or objects with a small margin.

Embed fonts (EPS on Windows only)

When you export to EPS format using Prism Windows, choose whether to convert the fonts to outlines. Learn the pros and cons of the two approaches 587.

Prism Mac does not offer the choice of converting text to outlines.

Defaults

Check an option at the bottom of the dialog to lock in your settings of format and options to use as the default for future exports. To change the default exporting location, use the File Locations tab of the Preferences 191 dialog.

17.3 The differences between export formats

Setting the default export format and the default for copying to clipboard

Set the default for how Prism copies graphs and layouts to the clipboard in the File & Printer tab of the Preferences dialog. Choose the export format in the Export dialog, and check an option at the bottom of that dialog to set the default for future exports.

PDF

Prism's PDF files encode vectors and fonts (not bitmaps), so the resulting file can be stretched to any size with no loss of quality. Export in PDF format when you can. Unfortunately, few Windows programs import pdf images, and few journals accept them. In contrast, PDF is the preferred format for transferring images between Mac programs.

Notes:

- If your graphs are in color, you will need to choose between RBG and CMYK color model. 586.

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- You don't have to have Adobe Acrobat to export PDF files. Prism creates PDF files on its own.

- When exporting several graphs or layouts, you can choose to export all of them to one PDF file. Or you can ask Prism to create a separate PDF file for each sheet.

- Prism Mac and Windows can encode transparent colors in PDF export.

TIFF or TIF

(Prism uses the extension TIF but it is identical to TIFF used by some other programs. The two are exactly the same, and you can rename from one to the other.)

This is a bitmap format, which means that your graph or layout is turned into a collection of dots. TIFF files tend to be trouble-free when submitted to journals. You need to choose resolution, color model, and size.

The resolution is expressed as dots per inch (dpi). Computer screens display images at about 100 dpi. Computer printers generally print at 300-600 dpi, and publications are generally printed at 1200 dpi. Journals typically ask for a file at 1200 dots per inch (dpi), the highest resolution that Prism offers.

Choose between two ways to express colors: RGB (designed for computer monitors or projectors) or CMYK (designed for printing). If you are submitting to a journal, follow their instructions. If in doubt, choose RGB. Prism Windows also lets you choose Monochrome files, which are pure black and white with no grays. If you choose RGB, Prism Windows lets you choose between 256 colors (smaller files) or millions of colors (larger file, but more accurate color rendition). Prism Mac always uses millions of colors.

Typically, graphs and layouts in Prism projects are much larger than publication size. If you ask for a graph at 1200 dpi at the actual size in Prism, you will end up with either a huge file or an out-of-memory error message. Avoid this problem by specifying the publication size. Let’s say your graph is 6 inches wide, but you will publish it with a width of 2 inches. By checking the option to reduce the graph to a width of 2 inches,

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you will create a file one-ninth as large (one-third the width times one-third the height).

With TIF format, and no other, Prism lets you choose to compress the file. The advantage of compressing, of course, is that the file is smaller. The disadvantage is that compressed TIF files might be less compatible with other programs.

With Prism Windows, choose between two compression methods. PackBits compression create the smallest file size, but LZW (Lempel-Ziv-Welch) compression might be more compatible.

Prism Mac does not offer you a choice of compression methods, it uses LZW compression

TIFF files exported by Prism (Windows or Mac) encode transparent colors.

EMF+, EMF or WMF (Windows only)

Windows Metafile (.WMF) and Enhanced metafile (.EMF) files contain vector and font instructions for how to draw the graph. This means you can resize the image (in another program) with no loss of quality. These formats are only used by Windows program, not Mac programs (and Prism Mac cannot export in these formats).

WMF is an ancient format; EMF is old, and EMF+ is the newest. So generally EMF+ is the best format. But not always. You may need to experiment to see which format works best for your needs, but these notes may help:

- Don't use WMF when exporting or pasting bar graphs with fill patterns to PowerPoint. If you use WMF, the patterns on such a graphs do not scale and appear of higher density.

- If you paste an EMF image into PowerPoint, the colors may change when you save then reopen the file. Not with WMF or EMF+.

- Choose EMF instead of "EMF+" to workaround the problem with somewhat corrupted graph when pasting EMF+ to older versions of Adobe Illustrator (CS5) or Corel draw. The problem is how Adobe Illustrator opens "EMF+" format that is generated by GDI+ in Prism.

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- Choose EMF instead of "EMF+" to when a graph is sent to PowerPoint and then exported to PDF. WIth EMF+, the fonts can change.
- Some very old programs do not support EMF. For these choose WMF.
- EMF and EMF+ files exported by Prism encode the transparent (clear) "color", but WMF files cannot encode transparency.
- EMF+ but neither EMF(old) or WMF can encode semitransparent (semi-clear) colors.
- EMF+ is a newer format than EMF but both kinds of files use the same .EMF extension.

EPS

Like PDF, EPS files contain vectors and fonts. The resulting file isn't just an EPS wrapper around a bitmap file. Prism Windows gives you the choice of converting text to outlines. If you do that, the image will always look right (no font files required), but you wont be able to edit text in other programs. If you include text as text, it can be edited elsewhere but font files are required. Prism Mac always converts text to outlines.

In theory, the EPS format is the best (tied with PDF). It encodes everything as vectors and fonts, so can be expanded or shrunk without any loss of resolution. In fact, submitting EPS files to journals is often problematic. Fonts and EPS files. 587

The EPS format is unable to encode transparency. If you choose any transparent colors in Prism, they will look solid in the exported file.

JPEG

The .JPG format is designed for photographs with gradients of similar colors. It is not a particularly good format for exporting for line art and graphs. Prism offers this choice because some journals insist on it, but we recommend that you use the .TIF format when possible. The only advantage of .JPG is that the files are smaller.

Most programs that export to the .JPG format give you a choice of compression. If you compress more, the files will be smaller but the resulting image won’t be as sharp. Prism gives you no choice. It only

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exports to the .JPG format with the least possible compression, making larger files but sharper images. Any compression would reduce the clarity of your graphs noticeably.

The JPEG format is unable to encode transparency. If you choose any transparent colors in Prism, they will look solid in the exported file

PNG

The .PNG format is great for posting graphs on web sites. PNG files use screen resolution, which is fine for displaying on screen but is too little resolution for submission to printed journals. There are no options of color depth.

Prism Windows can encode transparent colors in PNG export. Prism Mac cannot, and any transparent colors in your graphs become solid in the exported PNG file.

BMP

This is an older format that offers no advantages over other formats.

17.4 Exporting for publishing in journals

When you submit figures to journals for publication, you have to decide which format to use. Each journal has their own rules, and these sometimes change. But here are some general notes on preparing Prism graphs for publication.

Exporting as a TIFF file

Exporting as TIFF, our customers tell us, usually works well. Notes:

- In most cases, you will want the page background in Prism to be white, and to check the option in the Export dialog to include that color in the file.Transparent backgrounds can sometimes cause problems.

- If your journal asks for a tiff file without an "alpha channel", choose "White" for the Background color in Prism's Export dialog, not transparent or clear.

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- For resolution, try to follow your journal guidelines. It would seem to make sense to choose the highest resolution (1200 dpi) but some journals prefer 300 dpi. Definitely avoid the 100 dpi resolution, which is way too low for publication. Some of our customers say they always give the journal more resolution than requested, and this seems to work well for them.

- Choose the color model 586 requested by your journal. Different journal have different requirements.It seems that RGB is now more popular than CMYK, so choose RGB if you don't know what your journal wants. If your graph is entirely black on white, choose the monochrome or gray scale color model.

- For size, choose to make the exported file the exact width the journal wants. More. 588

- For compression, choose the LZW method, as it is standard and should not pose any problems to the journal production process.

Exporting as an EPS file

EPS files (encapsulated postscript) files encode the graphs as vectors and fonts, so have infinite resolution (except for any embedded pictures). They are more compact and sharper than TIFF or other bitmap files. Even if the journal you are submitting to doesn't list EPS as an acceptable format, ask them, since their printed guidelines may be out of date.

The problem of fonts in EPS files

Prism Windows (but not Mac) offers an option to convert fonts to outlines 587 when exporting to an EPS file.

The default is to save the text as characters, with references to the font. If you have used only standard fonts, this format lets the journal producers edit the text, or change the font and size. The only drawback is that if the file is opened on a computer that does not have the exact fonts you used, another font will be used and the look of the graph (or layout) will change. If you use standard fonts, we recommend this approach.

If you check the option to convert all text to outlines or glyphs, the look of your graph or layout will be preserved on any computer, even one that

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does not have the fonts you used. The disadvantage is that the text no longer is encoded as text, so the people processing your files at the journal will not be able to edit the text, change the point size or switch to a different font. We only recommend this approach if you use any unusual fonts in your figure, and are not sure if the journal computers will contain those fonts.

Prism Mac always converts fonts to outlines.

Adobe products offer a third way to deal with fonts that combines the best of the two approaches above, but Adobe has not provided the hooks our programmers would need to implement this approach. If you have access to Adobe Illustrator, here is an approach that is likely to work well. Export the graphs from Prism Windows without converting the text to outlines. Or try copy and paste. Then export from Illustrator in EPS format. We do not use Illustrator, so can't give you any detailed information.

Beware of the term *embedded font*. If your journal asks for that, clarify what they mean. Previous versions of Prism and some other programs used the term "embed" to describe converting fonts to outlines. Adobe, and some journals, use the term "embed" to the describe the third approach above, an approach that Prism does not offer.

Choosing a color model

If your graph is entirely black on white, choose the monochrome or grayscale color model.

If your graph includes color, choose the color model 586 requested by your journal. Different journal have different requirements. It seems that RGB is now more popular than CMYK, so choose RGB if your journal has not specified.

Previewing EPS files

Once you've exported an EPS file from Prism, you'll probably want to see it to make sure it is correct. With Macs, this is no problem. Just double-click on the file and it will be opened in Preview, a program that is part of the OSX system. What actually happens is that Preview converts from EPS to PDF, and displays the pdf image.

Windows, however, has no built-in program that can view EPS files. Adobe Illustrator seems to be the standard that many journals use, so import the EPS files into Illustrator if you can. If you don't have access to

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Illustrator, you'll have to find another program. Try double-clicking on the file to see if you already have a program that can open EPS files. Also try the free program GhostScript, which works OK. Another option is to export from Prism as a pdf file, and view that. This works because eps and pdf files contain mostly the same information, with a different "wrapper".

17.5 RGB vs. CMYK color models

The Export dialog requires you to choose between RGB and CMYK color models when you choose to export a graph (or layout) in the PDF, EPS, JPG (Mac only) or TIF format.

RGB (Red, Green, Blue) is based on projecting. Red light plus Green light plus Blue light all projected together create white. Black is encoded as the absence of any color. Colors encoded as RGB are sometimes called *spot colors*.

CMYK (Cyan, Magenta, Yellow, blacK) is based on ink. Superimpose Cyan ink plus Magenta ink plus Yellow ink, and you get black. White is encoded by the absence of any color. Colors encoded as CMYK are sometimes called *process colors*.

Even though it uses one more number to encode a color, the CMYK scheme actually encodes a smaller "color space" than does RGB. That means that the appearance of some colors will change when converted from RGB to CMYK. Most noticeably, bright colors in RGB (left side of figure below) will look duller and darker in CMYK as shown in the right side of the figure below.

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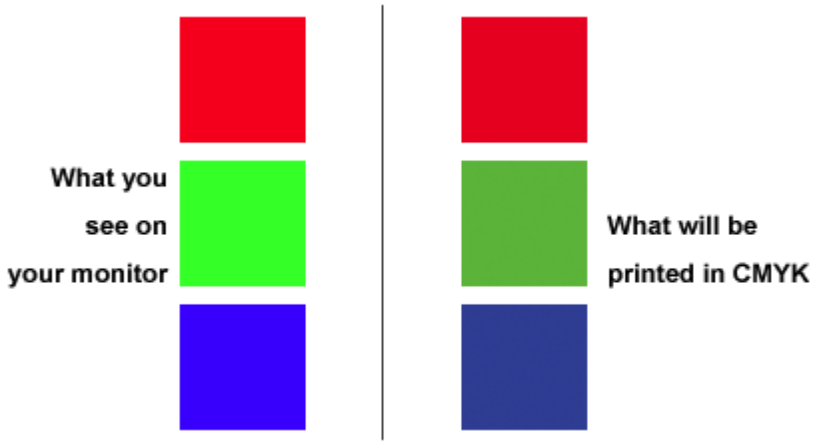

We recommend that you choose RGB when possible, as there will be fewer surprises. The colors will closely match what you see on the Prism screen (which internally uses RGB). Many scientific journals now request RGB.

Select CMYK only when submitting images to a journal that insists on CMYK.

Learn more about the differences between RGB and CMYK here and here.

17.6 Fonts and EPS files

Prism Windows (but not Mac) offers two choices about how to handle fonts when exporting to EPS format.

The default choice is to choice saves the text into the EPS file as characters, with references to the fonts you used. If you have used only standard fonts, this format lets others edit the text, and change the font and size. The only drawback is that if the file is opened on a computer that does not have the exact fonts you used, another font will be used and the appearance can change drastically.

A font that looks like this...

may come out looking like this

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Prism Windows also offers an option to convert all text to outlines, so that each letter is described as a set of graphic objects without reference to any font file. Prism Mac always exports EPS in this format. The advantage of this approach is that the look of your graph or layout will be preserved on any computer, even one that does not have the fonts you used. The disadvantage is that the text no longer is encoded as text. That means it is impossible to opens the .eps file and edit the text, change the point size or switch to a different font.

Adobe products offer a third way to deal with fonts that combines the best of the two approaches above. The font definitions themselves are included in the file, so the text remains as text, but will render perfectly on any computer. As far as we can tell, this choice only works within Adobe products and Adobe has not provided the hooks our programmers would need to implement this approach.

Beware of the phrase *embedding fonts,* as it is not used consistently. Adobe uses it to describe the third approach listed above (including font definitions in the file). Prism 5 and earlier (and some other programs) use the phrase "embedding fonts" to mean the second choice above (converting fonts to outlines or glyphs).

17.7 The size of exported graphs and layouts

How to change the size of a graph in Prism

When exporting a graph to submit to a journal, you will often want to set the exact width of the graph, and any other objects (text, legends, drawing, pictures, results tables) on the graph page. There are two ways to change the size of the graph in Prism:

- Set the width of the exported graph on the Export dialog.

- On the graph page. Drop the Change menu and choose Resize Graph.

A third possibility is to change the length of the X and Y axes in the Format Axis dialog. But just sets the axis length. The full graph will be larger when you consider titles, numbering, legends, drawing etc.).

We recommend the second approach above (change the size of the graph in Prism), as you can then check that nothing is too small. One guideline

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(from Cadmus, who handles production for many journals) is to make no font be smaller than 6pt, and no line be thinner than 1/2 point.

What happens when you resize exported images?

EPS, PDF, WMF, EMF files

The EPS, PDF, WMF and EMF formats are all based on vectors and fonts. These formats essentially store the instructions to draw the graph. You can stretch them to any size, and they should still look great. The only exception is if you pasted a picture onto your graph. Then that picture will remain a bit map in your EPS (etc.) file, and may not look great if its size is changed.

Even though it shouldn't matter, it is not a good idea to create an oversize graph, and expect the journal to reduce the graph size (and thus increase its resolution for TIFF files). Journals prefer that you export the graph at the size it will be published.

TIF, PNG, BMP, JPG files

TIF, PNG, BMP and JPG files encode bitmaps. If you stretch or shrink these images in another program, that program has to figure out how to create extra pixels or remove existing ones. Often the image becomes a bit blurry. It is much much better to resize in Prism (in the Graphs section) and then export the bitmap image file at exactly the size you want it to end up at.

If you want to know the size of an image, beware of viewing it after importing into another program. The size you will see in the other program depends on how that program deals with the mismatch of dots-per-inch (dpi) between the file and on screen, and also on what view zoom setting you have in that program.

It is easy to find out how large an image is in pixels, and its dpi:

- Mac. Double-click to open in Preview and then drop the Tools menu and choose Show Inspector.

- Windows: Double-click to open in Photo Viewer, then drop the File menu and choose Properties. (This works for Windows 7; other versions are similar.)

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17.8 Clear (transparent) background

What is a clear background?

Within Prism, there is no distinction between having a clear background and a white background. Both look identical on screen.

When you paste or export a Prism graph into another program, a clear background will let colors and objects show through, so Clear is not the same as White.

The problem is that not all export formats support the concept of transparency, and Prism doesn't support all formats. The JPG, and BMP formats simply have no concept of a clear background, so those file formats simply don't allow for the possibility of clear backgrounds.

Note that Prism lets you set two separate colors for the background of a graph. What Prism calls the background is the color of the 'page'. The plotting area color is the background color within the plotting area defined by the axes. Both can be set by right clicking (control-click for mac) on the graph, or by dropping the color wheel icon. Layouts, of course, only have the page background property.

Which export formats allow you to choose a clear background?

With Prism Windows, you can choose a clear background when you export in PDF, EMF, EMF+, WMF, TIFF or PNG formats. Prism Windows cannot export EPS images with clear backgrounds (but Prism Mac can).

With Prism Mac, you can choose a clear background when you export to PDF, PNG, TIFF, and EPS format.

This choice is in the Exporting options part of the Export Graph dialog, where you can choose to include a background color or export with a clear background.

Copying graphs and layouts to the clipboard

Choose on the File & Printer tab of Preferences whether you want Prism to copy graphs and layouts to the clipboard with the background color you specified in Prism or with a clear background.

Sending to PowerPoint

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Rather than copy and paste, we urge you to use the Send-to-PowerPoint command (a button at the right end of the toolbar, or a command in the File menu. The choice you make for sending background color (vs. transparent) to the clipboard (see prior section) also applies when sending a graph or layout to PowerPoint.

When you copy a graph or layout from Prism Mac, two versions are placed onto the clipboard. The PDF version supports transparent background and plotting area. Whether the background is clear or not depends on an option you set in Prism's Preference dialog (bottom of File & Printer tab). The bitmap version does not support a clear background. If you copy and paste, which version pastes depends on your version of PowerPoint and on whether you use Paste Special. Avoid the uncertainty by using the Send-to-PowerPoint command.

17.9 Exporting graphs with semitransparent colors

When you export your graph or layout, the semitransparent/clear colors 367 may or may not look semitransparent/clear in the exported image. It depends on what format you export in and on whether you use Prism Windows or Mac. In the table below, "Yes" means that semitransparent/clear colors will be encoded in the exported file, and "No" means they will not be.

Format	**Windows**		**Mac**	
	Semitransparent	**Clear**	**Semitransparent**	**Clear**
EMF	Yes	Yes	These formats are Windows only.	
EMF+	Yes*	Yes		
WMF	Yes	Yes		
EPS	No	No	No	No
PDF	No	No	Yes	Yes
TIFF	No	Yes	No	Yes
PNG	No	Yes	No	Yes
JPG	No	No	No	No
BMP	No	No	No	No

* Prism 8 only; not Prism 7

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17.10 One-click to Microsoft PowerPoint or Word

Send to PowerPoint or Keynote

The Send-to-PowerPoint command copies the current graph or layout, creates a new slide in PowerPoint, and pastes.

When you send to PowerPoint, it matters what the background color is in Prism. If the background is CLEAR in Prism, then Prism leaves the background alone in PowerPoint. If the background is any color in Prism, including white, then Prism changes the PowerPoint background to match. If your PowerPoint slide master has a background gradient or image that you want to keep, make your backgrounds in Prism clear, not white.

Send to Word (Windows only)

The Send-to-Word command copies the current graph or layout (or a set of graphs or layouts selected on the gallery 182), and pastes it into Word. Position your insertion point in Word before using this button.

This button is available on Prism Windows, but not Prism Mac.

Setting preferences for Send-to-Word or Send-to-PowerPoint (Windows only)

Open the Send to MS Office tab of the Prism Preferences 191 dialog.

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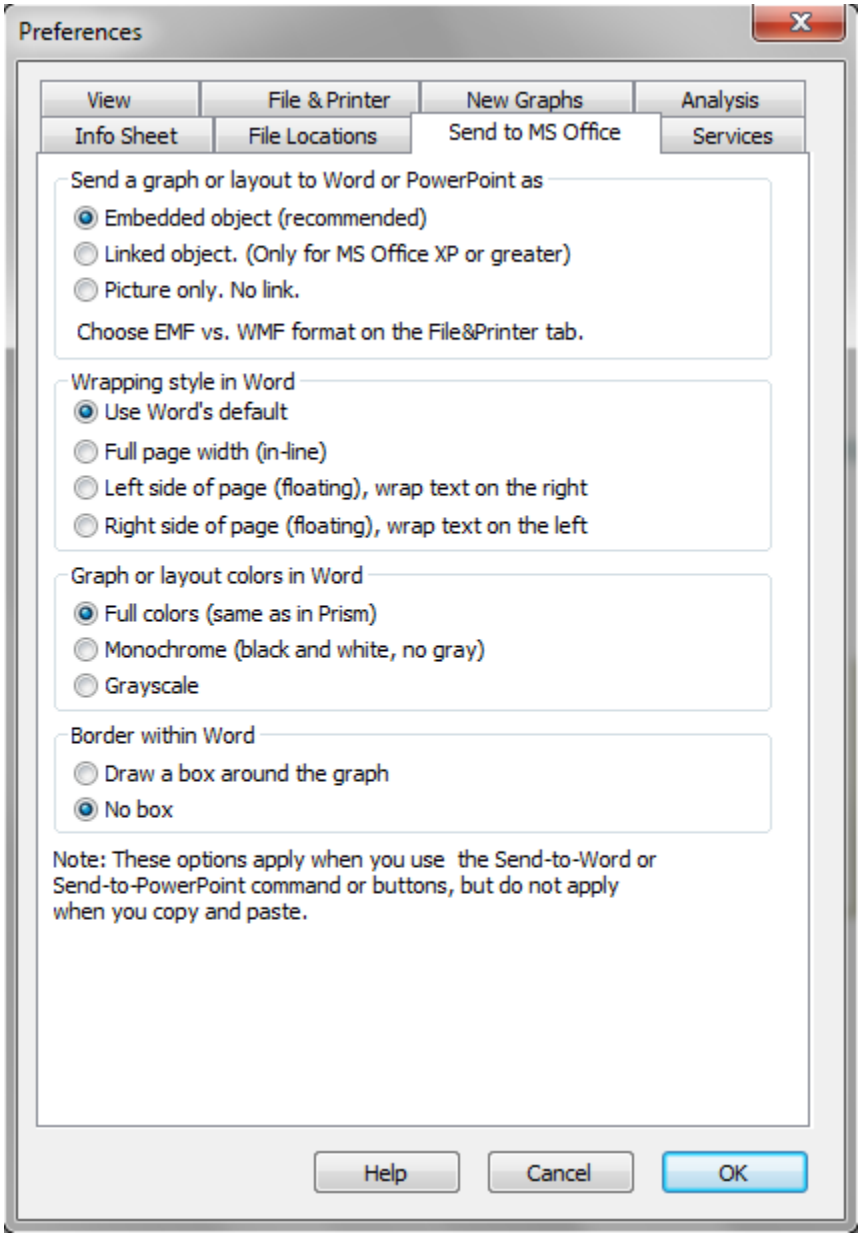

The most important choice (Windows only) is whether to embed, link, or send a picture 594. Embedding is the most versatile, but makes your Word or PowerPoint files larger.

When sending to Word, choose whether to display full colors, black and white, or gray scale. The latter two options simply set a setting within Word to display and print the graph in black and white or gray. If you embed or link, and double-click to edit in Prism, you'll see the graph in its original colors.

Problems sending to Word or PowerPoint? EMF(old) vs. EMF+ vs. WMF

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Windows supports three similar formats for describing images using vectors and fonts. The WMF (Windows Metafile) format is older. The EMF+ (Enhanced metafile) format is newer, and in theory a bit better. Prism can also use an older version of EMF. In fact, one format works better for some programs and the other format for others. It seems impossible to predict.

Choose which format to place on the clipboard (and to use when sending graphs to PowerPoint) at the bottom of the File & Printer tab of the preferences dialog. If you're having problems with pasted graphs looking funny, try another format.

17.11 Embedding or linking Prism graphs in other programs

This page applies only to Prism Windows. Object Linking and Embedding is not possible on the Mac. We wish it were.

The difference between pasting an object, a link or a picture

There are three ways to copy a Prism graph or layout and paste it into many Windows programs, including Word or PowerPoint.

Paste a graph or layout as a Prism object:

Prism will paste a picture of the graph, plus a copy of all the data, analyses and graphical settings needed to create that graph (or layout).

Double-click the object in the other program to edit it within Prism, where you can edit data, change analysis settings, and format the graph. When you exit Prism, the revised graph will appear in Word.

The advantage of embedding is that the Word or PowerPoint file is complete, containing the Prism data and settings. One disadvantage is that this makes the Word file larger. Another disadvantage (for some) is that it means your data can be stored in multiple places. If you realize the data was entered incorrectly, you will need to edit all the copies. Others see this as an advantage -- a way to backup your data.

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A Prism object only includes the data tables and results that are linked to the graph (or layout) that you pasted. Other parts of the Prism project are not included.

This is Windows only, and is not possible with Prism Mac.

Consider creating a drawing canvas in Word

In Word (but not PowerPoint) you can go to Insert, Shapes and select "New Drawing Canvas". That "canvas" is an area where you can combine images. Paste in a Prism graph, add text, import images, insert shapes and equations.... If you insert those items individually right on the page, they get entangled with flowing text. Putting them into a canvas keeps them together and away from the flowing text, and lets you control their arrangement with one another. Learn more.

Paste a graph or layout as a picture

A picture may be worth a thousand words, but it doesn't let you edit data, change analysis choices or reformat the graph. When you double-click on a pasted picture, you cannot edit it within Prism. Instead, you'll open up a generic graphic or photo editor.

An advantage of this approach (for some) is that people you send the file to won't be able see your data or edit your graphs. Because there is no need to store the data and settings, this approach doesn't take up so much disk space.

Paste a graph or layout as a link

Prism can paste a picture along with a link to the Prism file. When you double-click, Prism will be launched and open the linked Prism project. You can then edit the data, analysis settings, or graph in Prism. When you exit, the revised graph will be updated in Word or PowerPoint.

One advantage of this method (over pasting an object) is that your Word or PowerPoint files will be smaller. Another advantage (for some) is that it keeps your data in one place for easy editing. The disadvantage is that the link really is just a link to a file with a particular name in a particular place. If the linked file has been deleted, renamed or moved, you won’t be able to edit it. If you move the Word or PowerPoint to another computer, you won't be able to open the linked file unless it too is moved.

This is Windows only, and is not possible with Prism Mac.

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Insert object

If you insert a Prism object into Word or PowerPoint, you'll embed an entire Prism project. In contrast when you paste a graph as an object, you only embed the data and results linked to that graph.

Choose the Insert Object command from the other program's Insert menu (or in Office 2007, the right side of the Insert tab). Choose to create object from a file, and choose your Prism file.

The advantage of this method is that it includes the entire Prism project. This might be useful if you send a document to a colleague and want to include all supporting details.

This is Windows only, and is not possible with Prism Mac.

How to choose to paste an object, a link or a picture

One-click buttons to send to PowerPoint or Word

Choices in the Send to MS Office tab of Prism's preference dialog determine whether Prism's one-click Send buttons 592 send an object, a link, or a picture.

Copy and paste

When you copy a graph (or layout), Prism put all the necessary information on the clipboard so the pasting program can choose if it wants to paste a picture, an object, or a linked picture. Microsoft Word and Excel and older versions of PowerPoint paste an embedded object. PowerPoint 2007 and 2010 are different. By default, they paste a picture. To override this, drop the clipboard menu, choose Paste Special, and then choose to paste a Prism object.

Copy and Paste Special

Instead of pasting (and letting the program choose), use the Paste Special command, so you can choose which format is pasted. With most programs, Paste Special is a choice on the Edit menu. With Office 2007 and 2010, it is a choice on the Paste menu which is on the left side of the Home tab of the ribbon.

The Paste Special dialog lets you choose to paste an object ("GraphPad Prism 8 Project Object"), or a Picture ('Enhanced metafile"). You can also

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paste a bitmap, which might be useful if you want this Word or PowerPoint document to look nice on a Mac.

If you check this option to paste a link, the scrolling list gives you no choices. This option will not be available if you copy a graph from an unnamed Prism project, because linking requires that the Prism file has a name.

EMF+, EMF(old) or WMF?

Windows supports three similar formats for describing images using vectors and fonts. The WMF (Windows Metafile) format is older. The EMF+ (Enhanced metafile) format is newer, and in theory a bit better. Prism can also use an older version of EMF. In fact, one format works better for some programs and the other format for others. It seems impossible to predict.

Choose which format to place on the clipboard (and to use when sending graphs to PowerPoint) at the bottom of the File & Printer tab of the preferences dialog. If you're having problems with pasted graphs looking funny, try another format.

Editing a Prism object embedded in PowerPoint or Word

To edit a Prism object embedded in PowerPoint or Word, simply double click on it.

If you have multiple versions of Prism installed on your computer, Windows will choose which version to launch (the one used to create that object). But you can override that decision: Right click on the Prism object in PowerPoint, choose the Prism Object command, and then choose Convert from the submenu, and choose the Prism version you want to open that object.

Opening Prism objects with different Prism versions

What happens when you double click on a Prism object embedded in Word or PowerPoint (or elsewhere)? If the Prism version that created that object is present on your computer, that version of Prism will open it. If that version is not present, a newer version of Prism will open the file. But if the object was created with Prism 7, but the computer only has Prism 6, the object will not open. Instead you'll see a message that explains.

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After editing in Prism, updating the object in Word or PowerPoint

After editing an object in Prism, you'll want to push those changes to the program that holds the object, usually Word or PowerPoint. There are three ways to do this:

- Close Prism completely. To do this, click the "X" at the upper right of the Prism window. Or drop the File menu and choose Exit.
- Close the Prism "file" containing the object, but don't close Prism entirely. To this click the smaller "X" button at the upper right of the Prism window, just below the one that closes Prism entirely. Or drop the File menu and choose "Close and Return to ...".
- Close the Prism "file" containing the object, but don't update PowerPoint or Word. Ignore your changes, and leave Word or PowerPoint as they are. To do this, drop File and choose "Close But Don't Update..."
- Update the object in PowerPoint or Word while still leaving it open in Prism. To do this, click the Save button in Prism, or use the Control-S keyboard shortcut.

18 Printing

This section explains how to print graphs and

layouts, and how to change your printing options.

18.1 Two toolbar buttons for printing

The Print section of Prism's toolbar has two buttons for printing.

-Print the current sheet, or multiple sheets selected in the Gallery 182, using your default Print settings.

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-Bring up the Print dialog to choose a printer and which pages to print.

18.2 Printing data and results tables

Choose font size

Change the font size to control the size of the print on the page, and thus the number of pages needed to print a table. To do so, click the Zoom buttons. Or use the keyboard shortcuts: Use Smaller Font (Ctrl-J), Use Larger Font (Ctrl-M)

Note these buttons work differently in data and results tables than they do in graphs and layouts. When you are working with a table, the zoom buttons change the actual size of the font used, which will then change the size of the printed table. When working with a graph or layout, these buttons simply zoom what you see on screen, but do not change the actual size of the graph or layout when printed.

Portrait vs. landscape

Save paper, with some tables, by changing the Landscape/Portrait orientation when printing data tables, results, and info sheets. Go to File… Printer Setup for Windows (File… Page Setup for Mac). A single setting applies to all data tables, results sheets, and info pages in the entire project.

While you can change graphs and layouts from portrait to landscape orientation, you cannot o so on data or results tables.

Change column widths

Reduce column widths by positioning the cursor between column headings, and dragging to squeeze more onto each printed page.

Printing preferences

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These options on the File & Printer tab of the Preferences dialog affect printing of tables.

- Print grid lines on tables -- Check this box to include the horizontal and vertical lines on data and results tables. Omit it for a cleaner look.

- Print row and column labels -- When printing data tables, print the row numbers on the left of every page and the column letters on top of every page.

- Print the sheet name as header -- Print the sheet name, file name, and date on each page as a header. You'll probably want this header on pages placed in your notebook, but not on graphs submitted for publication.

18.3 Printing graphs and layouts

Page orientation

Each graph or layout can be set to be portrait or landscape. Since the page orientation setting in the portrait/landscape setting of the printer setup dialog only allows one setting per file, Prism ignores this setting for graphs and layouts.

Flipping the orientation of a graph

Click the rotate button in the Change toolbar and choose Flip.

Flipping the page orientation does not change the aspect ratio of the graph. You won't see the change on screen unless you zoom 155 down to see the entire page.

Flipping the orientation of a layout

Use the Flip button in the Change section of the Prism toolbar to change the orientation of a layout.

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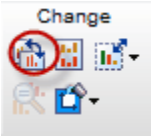

Printing preferences

Two options shown on the File & Printer tab of the Preferences dialog affect printing of graphs and layouts.

- Print the sheet name as header -- Print the sheet name, file name, and date on each page as a header. You'll probably want this header on pages placed in your notebook, but not on graphs submitted for publication.

- Print no grays and no colors -- Convert all colors to black. Don’t print colors as shades of gray.

Printing posters

Prism can print on very large pages (up to 1.5 by 2 meters) so can create a poster directly.

Choose the paper size by dropping the File menu and choosing Printer setup (Windows) or Page Setup (Mac). The details vary with each printer driver.

Since you can only set the page size once for the entire project, we suggest that you create your graphs in one project (or several projects) using a standard page size. Then make your poster in a separate project created just for that purpose. Set a large page size and then go to the layout section and create a layout sheet. Arrange the placeholders, and assign graphs from your other projects.

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18.4 Printing the gallery

Open a Gallery 148 page by clicking on the section title in the Navigator (Data tables, Results, Graphs, etc.). You'll see thumbnails of all the sheets in an array.

Distinguish two ways to print from the gallery.

Print selected sheets: Select the sheets you want to print. Then select the Print command or click on one of the Print buttons on the Prism toolbar.

Print the gallery page itself: Click on the Print button in the Prism toolbar and click the Gallery option in the Print dialog. Printing the gallery might be useful to create a table of contents for a lab notebook, or to see an overview of your work.

18.5 Custom page size

Windows

Windows lets you define custom page sizes.

You must first define the custom size in the Printer control panel. This is explained in this video (not created by GraphPad).

Once you create a custom page size in the Windows control panel, you can choose it in Prism's print dialog.

Mac

From Prism, drop the File menu and choose Page Setup. Then drop down the list of page sizes. At the bottom, find "Manage custom sizes".

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19 Scripts

Use a Prism script to automate the analysis of a large number of files. Prism's scripting language lets you open and close Prism files, import data, and export or print results and graphs.

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19.1 Overview of Prism scripts

Because Prism links data to graphs and analyses, a great deal of automation is built in. Simply edit or replace data or info constants, and everything will be updated. Although this built-in automation suffices for day-to-day lab work, it can be tedious when repeated over and over.

You can use a Prism script to automate the analysis of a large number of files, or simulate many data sets for Monte Carlo analyses. Prism's scripting language lets you open and close Prism files, import data, and export or print results and graphs. You can run Prism scripts from within Prism, or launch Prism from another program.

Note that Prism scripts do not tell Prism how to analyze or graph your data. That is built-in to the Prism project (or template). Use a script to import data into an existing project and to specify which results and graphs you want to export or print.

Scripts are small computer programs. Creating a script is slightly more difficult than using Prism. Experience with other scripting or macro languages is helpful, but is certainly not necessary. If you want to launch a Prism script from Excel, you will also need to learn a bit about Excel's macro language, Visual Basic for Applications.

To learn about scripts, first look over the examples we present in the next section. These examples show you the kinds of things that Prism scripts can do and give you a feel for how easy it is. Then read on to learn the details of Prism syntax. The final sections of this chapter explain how you can launch a Prism script from another program.

Can a Prism script control how Prism analyzes and graphs data?

No. A Prism script can open a Prism project file (or template), import data, and export results and graphs. But the details of how data are analyzed and graphed are stored in the Prism file. Note that when you change data, Prism updates the results and the graphs. This includes updating analysis constants and paste-linked data. For this reason, Prism scripts tend to be very short and easy to write.

Does Prism have an API that can be called from other programs?

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No. But other programs can launch a Prism script. Read the details about how this works with the Windows 644 and Mac 642 versions of Prism.

Can other programs create Prism files?
Yes 605.

19.2 Alternatives to scripting

Prism can save its project files in two formats. The PZFX format 160 includes all the data and info tables in plain text XML that other programs can view, edit or replace.

While other programs can't really create Prism files, they can start with a Prism file you have created, and replace the data. When a user then opens this file, the results and graphs will be updated.

To get an idea about how this approach works, follow these steps:

1. Create a Prism file, with data, analyses and graphs as you want them.

2. Save from Prism in the PZFX format.

3. Then open the file with a text editor (notepad). The analysis and graphing stuff is all encrypted in a way you can't access. But the data and info are in plain text, structured, XML.

4. Edit the data (and perhaps the info constants), and resave.

5. Double click on the file to open in Prism. You'll see that graphs and analyses are updated to analyze and graph the new data.

Using this approach, you can effectively (from the user's point of view) save a Prism file from your application (or instrument). No scripts. No need to use your software and Prism on the same computer at the same time. No need to even use the same platform (Win vs. Mac) for Prism and your program. All you have to do is replace the data portion of a .PZFX file, and resave it.

19.3 Example scripts

The easiest way to learn Prism's scripting language is to follow some examples.

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The examples are all for Prism Windows. The only difference on a Macintosh is that you use a colon instead of a backslash to specify disk names, folder names, and files. For example, the first line of the first example would read:

SetPath "Hard Drive:Prism 4:Data:June21"

Script example 1. Repeatedly import data 606

Script example 2. Monte Carlo analysis 607

Script example 3. Import several files onto one table 609

Script example 4. Open a template and import data 609

Script example 5. Import data and info constants from the script file 610

Script example 6. Import data into several tables 611

19.3.1 Script example 1. Repeatedly import data

This script analyzes a folder full of dose-response data stored as text files, perhaps from an instrument. It creates a single file that tabulates the logEC50 values along with the standard error and the R square of the fit.

Script command	Comments
SetPath "c:\data\june21\"	This sets the disk and directory to be used for the rest of the file.
OpenOutput results.txt	Create a file called results.txt to contain the output.
Table Text	Start a tab delimited text table in that file.
Open dr.pzfx	Open the Prism file dr.pzfx
ForEach dr*.txt	Loop for all files that begin with dr, have the extension .txt, and

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	are located in the disk and directory defined by the SetPath command.
Goto D	Go to the data section, to the data table last visited.
ClearTable	Erase all data from the table.
Import	Import the file defined by the ForEach statement into the first empty columns.
WTable “File name” %F	Write the file name into the output file.
Wtable “logEC50”, 5, 1	Write to the output table the value on the fifth row, first Y column (A), and label that column of the table “logEC50”.
WTable “SE of logEC50”, 11, 1	Write the SE of the logEC50 (from the 11th row of results) into the next column.
Wtable “R2”, 21, 1	Write the R2 value into the next column.
Next	Loop back to the ForEach statement and read the next file. Exit loop if no more files.
Beep	Signal completion.

19.3.2 Script example 2. Monte Carlo analysis

This is an example of Monte Carlo analysis. We'll simulate 500 data sets with random variation and fit a dose-response curve to each. This script creates a table containing the logEC50 and HillSlope from all 500 fits. Before running this script, you must create a file that has the first data

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table formatted for a one-grouping variable data set (no X, No Y subcolumns). The first results sheet must be one that simulates data with error. The second results sheet must be a nonlinear regression that fits a dose-response curve to the data.

Script command	Comments
Table Prism 1 Clear	Designate the first data table in your file to contain the results of this script. Delete all the contents of that table now (clear). Note this script requires that the first data table be formatted for one grouping variable data, with no X column.
ForEach 500	Loop 500 times.
GoTo R 1	Go to the first results sheet, which is a simulation.
Regenerate	Regenerate the simulation with new random numbers.
GoTo R 2	Go to the second results sheet. Since this sheet contains nonlinear regression results, Prism will automatically refit the data for each loop.
Wtable “logEC50”, 5,1	Write the value from the first Y column in row 5 to the first column of the output table, and label that column “logEC50”.
Wtable “Hill Slope”, 6,1	Write the value from the first Y column in row 6 to the next (second) column of the output table, and label that column “Hill Slope”.
Next	Loop back to the ForEach statement.

When the script is done, table 1 will have two columns and 500 rows. Each row will have the logEC50 and Hill Slope from one of the simulated experiments.

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19.3.3 Script example 3. Import several files onto one table

This example uses the script to import several files onto one data table.

Script command	Comments
SetPath "c:\Data\Oct2011\"	Define the disk and directory to be used by the rest of the commands.
Open rapid.pzt	Open the Prism template rapid.pzt that was created to contain a formatted data table.
GoTo D	Go to the data section.
ForEach Avge_*.dat	Loop through all files that start with Avge_ and have the extension DAT.
Import	Import into the first empty column.
Next	Go to the next file, which will be imported into the next column of the same table.

19.3.4 Script example 4. Open a template and import data

This example uses a script to launch Prism.

Script command	Comments
SetPath "c:\data\oct2011\"	Define the disk and directory to be used by the rest of the commands.
Open rapid.pzt	Open the Prism template file rapid.pzt
GoTo D	Go to the data table.
Import today.txt	Imports the file today.txt.

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GoTo G	Go to the graph section.
Save today.pzfx	Save the file with the specified name

While Example 4 would not be useful when run from Prism, it would be useful as a way to launch Prism.

For 32 nbit (x86) Windows: Create a shortcut icon with a target something like this:

```
"C:\Program Files\GraphPad\Prism 8\prism.exe” @”C:\Users\(current user)\Documents\”d
```

For 64 bit Windows: Create a shortcut icon with a target something like this:

```
“C:\Program Files (x86)\GraphPad\Prism 8\prism.exe” @”C:\Users\(current user)\Docum
```

Double-click that icon to launch Prism and run the script doit.pzc.

For Mac: You cannot create an icon that launches Prism running a certain script. All you need to do with Prism Mac is double-click on the script icon and that will launch Prism and run the script.

The script shown above instructs Prism to open a template (today.pzt) and import today's data (today.txt, presumably changing daily) into the file, and go to the graph. Once you have set this up (a few minutes) and also have a mechanism so the data file is updated daily (outside the scope of Prism), you simply double-click the saved file to see a new graph of today’s data.

19.3.5 Script example 5. Import data and info constants from the script file

Script command	Comments
GoTo D , 1	Go to the first data table.

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InsertData 1,0	Insert data from the script file, starting at row 1, column 0 (the X column).
<DATA> 1.000 564.1452 2.000 389.7727 3.000 138.9337 4.000 115.3119 </DATA>	Data block within script file. Adjacent values are separated by tabs.
GoTo I, 2	Go to second info sheet.
SetInfo "Experiment", 2, 0	Set the name of the second info constant.
SetInfo "345", 2, 1	Set the value of the second info constant.
SetInfo "Experimenter", 3, 0	Set the name of the third info constant.
SetInfo "Dan Brown",3, 1	Set the value of the third info constant.
SetInfo "[Potassium]", 4, 0	Set the name of the fourth info constant.
SetInfo "3.45 mM", 4, 1	Set the value of the fourth info constant.

It would not make sense to create this script by hand, but it would be very useful if created by another program.

19.3.6 Script example 6. Import data into several tables

Before running this script, create a Prism file with 9 data tables each linked to a graph, and all the graphs placed on one layout.

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Script command	Comments
GoTo D	Go to the data section.
ForEach 9	Loop nine times.
GoTo %N	Go to the Nth data table, where N is the loop number.
Import Data%N.txt	Import the data file. Data2.txt goes into the second table, Data3.txt goes into the third table, and so on.
Next	Loop.
GoTo L 1	Go to the first layout, which was setup to show all nine graphs.
Print	Print the layout.

19.3.7 Script example 7. Changing the X-axis title of all graphs

Script command	Comments
GoTo G	Go to the graphs section.
ForEachSheet	Loop over all sheets in this section.
SetAxisTitle X, "Time (minutes)"	Change the X axis tite.
Next	

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19.4 Script details

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19.4.1 Script syntax

Punctuation in scripts

- Each script command begins with the command name. Most commands then have one or several arguments.
- Separate the command name from the arguments with a space.

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- Separate the arguments from each other with spaces or commas.
- Use upper and lower case letters interchangeably.
- Add extra spaces to improve readability.

How optional and required parameters are shown in the Help pages

- Required arguments are shown in square brackets [like this].
- Optional arguments are shown in angled brackets <like this>.
- Lower case arguments describe a value you will enter.
- Uppercase arguments are the exact word you need to type if you want that option.

19.4.2 Navigating a project

Commands

GoTo <section: D, I, R, G, or L >, <sheet#>, V<tab#>

GoTo +

Explanation

The **GoTo** command is used in almost every script, to navigate to a different sheet in the project as these examples show:

Example:	Description:
GoTo G	Go to the graphs section, to the most recently viewed graph.
GoTo 3	Go to the third sheet of the current section.
GoTo G, 3	Go to the third graph.
GoTo V2	Go to the second analysis tab of the current results.

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GoTo R, 3, V2	Go to the second analysis tab of the third results sheet.
GoTo +	Go to the next sheet in the current section.
GoTo -	Go to the previous sheet in the current section.

Notes:

- Prism numbers the sheets so the first sheet is #1. This seems normal to everyone except computer programmers, who expect the first one to be #0.
- Don't forget to include a space (or comma) between the results and the view. The command "GoTo R4V2" goes to the default (current tab) of results sheet 4, and the view (analysis tab) part of the command is ignored.

19.4.3 How rows and columns are numbered

Many commands let you specify a particular row or column number.

Column numbering

- The Row Title column, if there is one, is number -1.
- The X Column, if there is one, is number 0.
- Column A, is column 1.
- Column B, is column 2, etc.

Row numbering

- The Column Title row, if there is one, can be referred to either as row 0 or -1 (to be consistent with column titles).

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- The other rows follow the row number shown on the table. So the first data row is #1. This seems obvious to most, but people familiar with other computer languages may expect the first row to be #0.
- It is not possible to access subcolumn titles via script.

19.4.4 Adding comments to a script

Add comments to your script following these examples:

Commands

```
//single comment line
/*
  Several lines
  of comments.
*/
```

19.4.5 Loops and simulations

Commands

ForEach [# of loops]

ForEach [filespec, i. e. ”C:\data\DR*.txt”]

ForEachSheet

Next

Regenerate

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Explanation

The heart of many scripts is a loop. You can loop a certain number of times (for simulations), over all matching files (repeated importing), or over all sheets in a section (to print or export…). End the loop with a Next statement. You cannot nest loops.

Starting and ending the loop

There are three ways to start a loop:

- Loop a specified number of times (example 607): **ForEach 100**.
- Loop over a set of files (example 606): **ForEach *.CSV**
- Loop over all sheets in the current section: **ForEachSheet**

For all three kinds of loops, the **Next** statement ends the loop.

Regenerate random numbers

One common use of a Prism script is to do Monte Carlo analyses. First create a Prism file that uses the analysis 'Simulate data with random scatter" to generate data, and links those simulated data to another analysis (say a nonlinear regression). Inside each loop, use the GoTo command to go to the analysis page that generates the data, and use the Regenerate command to create new 'data' (with different random scatter). Then go to the results, write out selected results, and use the Next command to loop again. See script example 2 607 at the beginning of this chapter.

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19.4.6 Using variables when outputting text

The Prism scripting language lets you use these four variables in any command that exports text. They are mostly useful inside of loops 616.

- %F. The name of the file. This is useful in ForEach loops that import a set of files. %F is the file name before the period.
- %X. The file extension (without the preceding period).
- %S. The name of the current sheet. This is useful when looping over all sheets in a file. You may also use this variable outside of a loop.
- %N. The loop number. This is useful in simulations, which loop a set number of times.
- %%. This outputs the percent symbol, %.

These variables can be preceded and/or followed by other text. They can only be used within a script loop. Note there are additional variables 631 you can use when writing text.

19.4.7 Creating new sheets

Commands

DuplicateDataTable <CLEAR>

DuplicateFamily [prepend_text] <CLEAR>

CreateLayout [#rows] [#columns] <orientation> <#StartingGraphIndex> <#Graphs>

Explanation

DuplicateDataTable

For the most part, script commands navigate among sheets you have already created by hand. You can't create new data tables, new analyses or new graphs in a script except by duplicating existing ones. When you

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duplicate a data table, all you get is a new data table. You can import data into it, but not analyze or graph within the script.

DuplicateFamily

Duplicates a sheet as well as all linked sheets. Import new data to replace the existing data, and all analyses and graphs will update.

All new sheets include the prepended text in front of the sheet name. Enter %F as the prepend text, to use the name of the most recently imported file.

CreateLayout

Create a new layout with an array of placeholders with the specified number of rows and columns on a page of the specified orientation "portrait" or "landscape" (portrait is the default). Assign graphs starting with the specified one. Specify by rank order in the navigator, with "1" as the first graph. If you specify GraphsCount, Prism will assign that many graphs only. If you omit this parameter, Prism will stop when it has reached either the last placeholder on your layout or the last graph in the project

19.4.8 Changing data tables

Commands

SetYReplicates [#]

ClearTable <row>,<col>,<subcol>

DeleteAllDataSets <CLEAR>

Explanation

Using a script, you have limited ability to change a data table.

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The **SetYReplicates** command changes the number of Y replicates (subcolumns), but script commands can not make other changes to the data table or number (decimal) format.

The **DeleteAllDataSets** command deletes all data and all links to analyses and graphs.

The **ClearTable** command erases all data to the left and below of the designated cell (including the cell itself) but maintains links to analyses and graphs.

19.4.9 Changing graphs

Commands

ApplyColorScheme ["scheme name"]

SetAxisTitle [which axis: X, Y, or Y2] ["new title"]

SetGraphTitle [“new title”]

SetAxisLimits [which axis: X, Y, or Y2] <segment #> [Top/Bottom/Interval] [value]

Explanation

You must create graphs manually (or by duplicating). You can’t change most graph properties via scripts, but you can apply a color scheme, change the limits of an axis, and change the graph or axis titles.

When entering the graph or axis title, you can only enter plain text, and Prism does not provide tools to enter Greek letters, math symbols, superscripts or subscripts. But note that Windows lets you enter some special characters by holding Alt and typing its four digit code. For example, alt-0181 enters the Greek letter mu.

To use the % symbol in an axis or graph title, enter it twice. The command "SetAxisTitle Y %% Complete" changes the Y axis title to "% Complete". This is because the % symbol is used to indicate a variable.

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Each use of the SetAxisLimits command lets you change the range (minimum and maximum values) or interval of an axis. Each use of the command only lets you change one of those values. If you want to change the Y axis (left Y) so it ranges from 100 to 200 with an interval of 10, you need to use this command three times (in any order):

```
SetAxisLimits Y top 200
SetAxisLimits Y bottom 100
SetAxisLimits Y interval 10
```

If the Y axis was split into two segments, you need to specify which segment to change. The first (left or bottom) segment is '0', and the second segment is '1'. If you wanted to change the bottom segment, use these commands. Note that it is not enough to specify the segment number; you also need to include the word 'segment'.

```
SetAxisLimits Y segment 0 top 200
SetAxisLimits Y segment 0 bottom 100
SetAxisLimits Y segment 0 interval 10
```

After you change a graph using a script, linked layouts won't update unless you write script commands to go to that layout. Here is a script that flips through all the layouts, so ensures they are all up to date.

```
Goto L
ForEachSheet
Next
```

19.4.10 Setting the default drive and folder

Commands

SetPath ["drive and folder path"]

Explanation

All the commands that read and write files use the path set in the SetPath command unless you specify a different drive or folder in the other commands. For Windows, use these examples:

SetPath "C:\Users\(current user)\Documents\007\goldfinger\oddjob"

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SetPath "(local drive):\DataFiles\August2005\"

SetPath "\\LabServer\DDrive\PrismFiles"

The last example opens a file on another computer named "LabServer". In this case you don't use the "C:" notation for hard drives, but rather refer to the name of the drive ("DDrive" in this example.)

On the Mac, use a format like this:

SetPath "Hard Drive:Prism 4:Data:June21".

If you prefer to specify the path within each individual command, you can still use the same formats as shown above.

19.4.11 Opening and saving Prism Files

Commands

Open ["filename"]

Close

Save <"filename">

Explanation

Scripts can either be saved as part of a Prism file, or in a separate script (.pzc) file. When the script is running from a separate file, the Open and Close commands let you switch between Prism files. The script commands work on the last opened file. You may open several files at once. To go back to a file you already opened, simply reissue the open command again.

If you don't include a disk and directory, Prism will look in the directory (folder) specified by the SetPath command. Include the file extension (.PZF, .PZFX, .PZT or .PZM). If no SetPath script command was used Prism, Prism uses the temporary folder.

Unlike the Import command, the Open command by itself will not automatically open the next file file in a ForEach loop. To do so, use this syntax: Open %F.PZFX. That opens the next file in the loop (%F) with the extension .PZFX (which you may want to change to .PZF).

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The Close command does not save the file, so issue the Save command first if you want to keep the changes. Include a file name with the Save command to create a new file. Omit the file name to save changes using the same name.

The Save command saves to either .PZF or .PZFX format, depending on the file name you enter.

19.4.12 Importing data from a text file

Commands

Import <”filename”>, <row>, <col>, <subcol>

ImportLink <”filename”>, <row>, <col>, <subcol>

Explanation

The Import command imports data from a text file into a data table. The ImportLink command replaces data in a data object file using existing choices for filtering and rearranging

If you omit the filename and are in a ForEach file loop, Prism will use the current loop’s file. If you include a file name, don’t precede it with a path, Prism will use the path defined in the SetPath statement if there is one.

If you want to import starting at a particular row or column, specify them. Row 0 is the title row, and row 1 is the first row with data. Column 0 is the X column, and column 1 is the first Y column. Column -1 contains the row titles. It is not possible to import subcolumn titles.

The advantage of the ImportLink command is that it lets you specify which parts of the file to import and how to rearrange the data. Before creating the script, manually import a data file and choose the option to maintain a link between Prism and the data (text) file. At this time, choose options on the Filter and Placement tabs of the Import dialog to

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select rows and columns to import and rearrangements (such as transpose). These properties are stored with a data object. See Data objects in Prism 263. The ImportLink command then replaces new data, using the same properties.

If there is only one data object on the table, don't specify row, column, or subcolumn. Prism simply uses the only data object on the table.. If there is more than one data object you need to specify the row, column, and subcolumn of the upper-left corner of the data object you wish to import into.

Note that the ImportLink command updates a Prism data object linked to a text file. If you Paste Link data from Excel, you cannot update the link using this command. You'd need to write VBA code in Excel to change the data in Excel.

19.4.13 Importing data from the script file

Commands

InsertData <row>, <col>, <subcol>

InsertDataLink <row>, <col>, <subcol>

Explanation

If you create the script file from within another program, you can include data and info constants within the same file as the script commands.

The InsertData command imports data included within the script file, into the current data table, starting at the specified position. The data are included right in the script file enclosed between the tags <Data> and </Data>. The rest of the script continues right after the </Data> tag.

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InsertData

<Data>

1, 2, 4

5, 7, 9

</Data>

The InsertDataLink command imports data included within the script file, into a data object whose upper left position is at the indicated position. This works similarly to the ImportLink 623 command.

If you want to import starting at a particular row or column, specify them. Row 0 is the title row, and row 1 is the first row with data. Column 0 is the X column, and column 1 is the first Y column. Column -1 designates the row titles.

19.4.14 Copy and paste

Commands

Copy

Copy [#rows] [#columns] [first row] [first col] <first subcol>

Paste [first row] [first col] <first subcol>

Paste

Explanation

From a data, info, or results table, copy selected values to the clipboard.

If you use the Copy command with nothing else, Prism copies the entire sheet to the clipboard.

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You can also specify which range to copy. Note that #columns includes subcolumns. So if you want to paste triplicate values into two adjacent columns, you need to enter #columns as 6 (or 7 if you also paste an X column).

If you use the Paste command with no arguments, Prism will paste the entire table starting at the current position of the insertion point.

Copy and paste use the Windows or Mac system clipboard, so will overwrite any other information copied to the clipboard.

Example

Copy 1, 9, 5, 10

This selects and copies one row (row 5) and nine columns or subcolumns (starting at column/subcolumn 10).

19.4.15 Changing info constants

Commands

SetInfo ["value"] [rownumber] <position: 0 (name) or 1 (value) or 2 (notes)>

SetValueToInfo [infotable #] [inforow#] [datarow] [datacol] <datasubcol>

Explanation

The **SetInfo** and **SetValueToInfo** commands inserts (or changes) a value into an Info sheet.

With the **SetInfo** command, set position to 0 to change the name of the constant, 1 to change its value (the default choice), or 2 to append to the notes (in which case the row number is ignored).

Examples:

SetInfo 5.3, 3

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Setinfo "Notebook 25, page 34", 5

Setinfo "Experimenter", 3, 0

Setinfo "Dennis", 3, 1

Setinfo "Notebook 2007H, page 304", 1, 2

The first example sets the third constant equal to 5.3. The second example sets the fifth constant to “Notebook 25, page 34”. The third example names (or renames) the third constant to “Experimenter”. The fourth example assigns the value “Dennis” to that constant. The fifth example adds some text to the notes portion of the info page.

With the SetValueToInfo command, the value comes from a data, results or info table. You must first navigate to that table using the Goto script command. Then specify the row and column (and perhaps subcolumn) of the cell with the value you want to use, and which row of which info table you want to ‘paste’ that value into. Example:

SetValueToInfo 2, 4, 14, 0

From the table that a prior Goto script command has taken it to, find the X value (column 0) in row 14. Put a copy of that value in the fourth row of the second info table.

19.4.16 Exporting a graph or layout

Commands

ExportWMF [filename] <CLEAR> (Windows only)

ExportEMF [filename] <CLEAR> (Windows only)

ExportTIF [filename] <resolution> <mode> <compress or LZW> <CLEAR>

ExportBMP [filename] <mode><resolution>

ExportPNG [filename] <resolution><CLEAR>

ExportJPG [filename] <mode> <resolution>

ExportEPS [filename] <mode> <CLEAR> <nofonts>

ExportPDF [filename] <mode> <CLEAR>

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ExportAllPDF [filename] <mode> <CLEAR>

Explanation

For the formats that let you set resolution (dots per inch), enter 100, 300, 600 or 1200. You cannot enter other values. The default is 300 dpi.

For EPS or PDF export, set the mode to “RGB” (256 colors, default), “CMYK” or “Grayscale”

For TIFF export, set the mode to “RGBlow” (256 colors, 8 bits), “RGBhi” (millions of colors, 24 bits), “CMYK” (default), “GRAY” or “MONO”. Note that “MONO” means black and white only, with no grays. CMYK and RGB are two ways of denoting colors.

For TIF export, include the "compress" option to save the file using "PackBits" compression, which will make the file smaller but perhaps less compatible. Or use the "LZW" option (Windows only) to compress using the Lempel-Ziv-Welch algorithm, which doesn't compress quite as well as PackBits, but may be more compatible with some programs.

For EPS export, choose nofonts to not include fonts. This makes the EPS file smaller and more compatible, but requires that the same fonts be present on the computer used to import the file.

If your page has a colored background, you will see that background in the exported file, unless you include the parameter "CLEAR" to export the graph or layout with no background color (only allowed for some formats).

For all export commands, Prism will use the SetPath location if you don't specify disk and directory.

ExportPDF exports the current graph or layout. ExportAllPdf exports all the graphs (or all the layouts) into one multipage file.

If you use “%F” to export a file with the same name as the imported data table, remember to append an extension. For example “ExportWMF %F.WMF “.

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19.4.17 Exporting data, results or info tables

Commands

ExportTable [filename] <ALL>

Explanation

If used from a data or results table, this command exports the entire table. The format will depend on the extension you give the file name. Choose from tab-delimited text (.txt), comma-delimited text (.csv), or Prism XML (.xml).

If used from an info table, and the filename is a .txt file, this command exports only the notes (and not the info constants). If the file name is an .xml file, then this command exports both info constants and notes. If you want to export only info constants, use the WSheet command 631 instead.

If you choose the XML format, and include the ALL option, all data and info tables will be exported.

You can also export the values in a data table or results sheet to a table created by a script. 629

19.4.18 Writing to Prism, text, HTML, XML or SQL tables

Commands

Table Prism [datatable number] <CLEAR>

Table Text <&> <delimiter>

Table CSV <'delimiter'>

Table HTML <border #> <width #>

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Table XML [filename]

Table SQL [datasource] <table > <login> <password> <CLEAR>

WTable [column title] [row] [col] <subcol>

WTable [column title] [text or %F or %N]

NextRow

EndTable

OpenOutput ["filename"] ,<CLEAR>, <"delimiter">

Explanation

These commands make it easy to export Prism results into structured tables. The first step is to define your table. Choose to place the results into a data table within Prism, to a text file (delimited with tabs), to a CSV (text file delimited with commas), to a HTML (web) table, to an XML table, or directly to a ODBC connected database. If you choose to write to a text, CSV or HTML file, create the file using the **OpenOutput** command before creating the table. This lets you combine other information (as explained in the next section) as well as the table. XML output must be in its own table, so enter its file name as part of the Table XML command.

Use the **WTable** command to write a value into the table. The first argument will become the column title in the new table (or the variable name when exporting to a database). The next three arguments define the cell on the current results (or data) table that will be written to the new table. Or enter text to just space columns apart, or %N to put in the loop number or %F to put in the current file name.

Note that the **Wtable** command has a name that can be misleading. It writes a single value (or text string) to a table. The command does not write an entire table. If you want to write an entire results (or data) table, use the WSheet command 631.

In almost all cases, you'll create a table as part of a loop. The Next statement that ends the loop also starts the next row on the table. When the loop is complete, so is the table. In rare circumstances, you might not want the end of a row to correspond with the Next statement of a loop. In this case, end a row with the **NextRow** statement, and close the table before the loop ends with the **EndTable** statement.

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19.4.19 Writing to text files

Commands

OpenOutput [“filename”] ,<CLEAR>, <”delimiter”>

WText <"text"> <;&>

WDate <;&>

WTitle

WCell [row], [col], <subcol> <;&>

WRow [row], <col>, <subcol> <;&>

WCol [row], <col>, <subcol><;&>

WSheet <row, col, subcol><;&>

WBlock [row(s)] [column(s)] <row label> <;>

WTCol [row, col] <, subcolumn><;&>

WTRow [row] <,col, subcol> <;&>

WTSheet <row, col, subcol><;&>

WTBlock [row(s)] [columns to include] <row label> <;>

WVersion

CloseOutput

Explanation

Prism offers two methods for writing results from a script. The previous section explains how to write tables. A more general method, writing to a text file, is explained here. Generally, you’ll find it easier to write to tables (previous section) but may find uses for the extra flexibility of writing to text files.

The first step is to use the **OpenOutput** command to open (or create) a file to contain the text the script will output. If you don't precede the file

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with disk and directory, Prism will use the path defined in **SetPath**. If there is no **SetPath** command, then Prism assumes that you want to use the directory that contains the script. If you include a delimiter, say "," it will appear between entries. Otherwise the output file will be delimited with tabs.

If the output file already exists, Prism appends to that file unless you have included **CLEAR**.

Results will be tab delimited unless you include an alternative delimiter in the **OpenOutput** statement.

Examples:

OpenOutput C:\gp25\output.txt, Clear

OpenOutput C:\data\july97, ","

You can write (export) data and results to the text file using any of the commands that begin with W (or by creating a text or CSV table as described in the next section).

If you end any of the W commands with a semicolon, the next W command will add text to the same line, following a tab. If you end with an ampersand (&), the next W command will add text to the same line, without a tab. If you omit the semicolon or ampersand, Prism inserts the codes for carriage return and line feed so the next W command will write to the next line in the file.

The most useful **W** command is **WCell** which writes out the contents of one cell in a data or results table. You need to specify the row and column of the cell to write. Row 0 refers to the row of column titles, and row 1 is the first row of data. Column 0 refers to the X column, and column 1 is the first Y column (column A).

You can also write out entire rows or columns, or the entire sheet, at once. The commands that begin with **WT** transpose the data (so each row becomes a column) before writing to the text file.

WVersion writes the version of Prism you are using, to fully document your results.

Note that the **WTable** command is distinct 629 from the set of commands described here, despite the fact that it begins with the letter W.

Read more about WBlock and WTBlock 633.

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Variables

Use the following variables when writing text:

- %D Date and time this file was last saved, e.g. "Tuesday, September 16, 2014 4:08:10 PM"
- %P File name of the Prism project
- %S Sheet name
- %V Prism version

19.4.20 The WBlock and WTBlock commands

These commands were introduced in GraphPad Prism 6.04 and 6.0e. The idea is to specify a block (range) of cells to write to a text file already specified in an OpenOutput command.

WBlock script command

Syntax: **WBlock [row(s)] [column(s)] <row label> <;>**

Rows

The parameter for rows can designate a single row, a row down to a blank row, a range of rows , or a list of rows which can be in any order. You must have used the OpenOutput script command first to specify where the results will be written.

What you enter	How Prism interprets it
7	Only row 7. Of course, row 7 is the row labeled with a 7 in front of it, so row 0 is the column titles.
"7"	Only row 7
"7-"	Start at row 7 and keep going until you hit a blank row

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“7-12”	Start at row 7 and end at row 12. Note that the second number is the ending row, not the number of rows.
“7, 11, 9, 8”	Specified rows in that order.

Columns

The parameter for columns can designate a single column, a column across until an empty column, a range of columns, or a list of columns which can be in any order. You must have used the OpenOutput script command first to specify where the results will be written.

What you enter	How Prism interprets it
3	Only column 3. The column of row titles (if it exists) is column 0. Column 1 is column A, but for some results there are no A, B, C column labels.
“3-3”	Only column 3. The column with titles is 0, so in the example above, this is the “significant” column
“3”	Only column 3.
“3-“	Start at column 3 and keep going right until a column is empty (or the end of the table).
“3, 4”	Columns 3 and 4
“3-6”	Columns 3, 4, 5 and 6.
“3, 8, 4”	Columns 3, then 8 then 4. Note that the order in the results will not match the order in the Prism table. Also note that I included spaces after the commas which are ignored.
“3,8,4”	“

Row label

The parameter row label would must be quoted text. That text will appear as the first item in every row output. If the WBlock command ends with a semicolon, then there is no delimeter (no tab, no space, no comma) after that text. If there is no semicolon, then the row label text is separated from the next column just like all the columns are separated (tab unless an alternative is specified in OpenOutput command). If there is no row label (as it is an optional parameter), then a semicolon at the end of the command is ignored and has no impact.

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WTBlock script command

The WTBlock command has the same syntax as WBlock. Note that the label is applied to each row as output (which is each column in the Prism table)

WTBlock [row(s)] [columns to include] <row label> <;>

Examples

Here are results of one way ANOVA followed by Dunnett's test from Prism 6.04 (the results show two new columns that were not in prior releases):

	1way ANOVA Multiple comparisons								
1	Number of families	1							
2	Number of comparisons per family	4							
3	Alpha	0.05							
4									
5	Dunnett's multiple comparisons test	Mean Diff.	95% CI of diff.	Significant?	Summary	Adjusted P Value	A-?		
6									
7	Control vs. Treated	-38.33	-52.38 to -24.29	Yes	****	< 0.0001	B	Treated	
8	Control vs. Treated+Antagonist	-3.500	-16.89 to 9.894	No	ns	0.8965	C	Treated+Antagonist	
9	Control vs. Treated+Agonist	-16.73	-30.78 to -2.685	Yes	*	0.0166	D	Treated+Agonist	
10	Control vs. Solvent Blank	-1.733	-15.78 to 12.31	No	ns	0.9923	E	Solvent Blank	
11									
12									
13	Test details	Mean 1	Mean 2	Mean Diff.	SE of diff.	n1	n2	q	DF
14									
15	Control vs. Treated	44.67	83.00	-38.33	5.339	6	5	7.179	22
16	Control vs. Treated+Antagonist	44.67	48.17	-3.500	5.091	6	6	0.6875	22
17	Control vs. Treated+Agonist	44.67	61.40	-16.73	5.339	6	5	3.134	22
18	Control vs. Solvent Blank	44.67	46.40	-1.733	5.339	6	5	0.3246	22
19									

The results are shown here as tables. In fact, they will be tab-delimited text (or comma delimeted, if that is set in the OpenOutput command).

Example 1

```
WBlock "7-", "6,4", "PSummary"
WBlock "7-", "6,3", "Significant?"
```

The results will be as shown below. Here it is a table. In fact it will be tab delimited text. (The delimeter is set in the OpenOutput script command, and defaults to tabs).

```
Psummary	B	****
Psummary	C	ns
Psummary	D	*
```

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Psummary	E	ns
Significant?	B	Yes
Significant?	C	No
Significant?	D	Yes
Significant?	E	No

Example 2

```
WBlock "7-", "6,4", "PSummary";
WBlock "7-", "6,3", "Significant?";
```

The results will be as shown below. Note the semicolon after the labels, so in both cases the label and the columnID column run together.

PsummaryB	****
PsummaryC	ns
PsummaryD	*
PsummaryE	ns
Significant?B	Yes
Significant?C	No
Significant?D	Yes
Significant?E	No

Example 3

```
WBlock "7-", "7,4", "PSummary"
WBlock "7-", "7,3", "Significant?"
```

Here there is no semicolon, so the labels have their own column.

Psummary	Treated	*** *
Psummary	Treated+Antagonist	ns
Psummary	Treated+Agonist	*
Psummary	Solvent Blank	ns
Significant?	Treated	Yes
Significant?	Treated+Antagonist	No
Significant?	Treated+Agonist	Yes
Significant?	Solvent Blank	No

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Example 4

```
WTBlock "7-", “7,3,4”
```

Treated	Treated+Antagonist	Treated+Agonist	Solvent Blanks
Yes	No	Yes	No
***	Ns	*	ns

Example 5

```
WTBlock, “7-“, 3, “Significant?”
```

Significant?	Yes	No	Yes	No

Prism file

19.4.21 Send to Microsoft Office

Commands

SendToWord

SendToPP

Explanation

These commands send the current graph or layout to Word or PowerPoint.

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19.4.22 Special purpose commands

Commands

SetProjectName ["new name"]

SetScriptDialogTitle ["dialog title"]

RecalcAll

Beep

Createlog

SetSheetTitle [new_name] <K>

CloseScriptDialog

Print

Exit

Explanation

Use the **SetProjectName** command to change the name of the project file (the name it will have when next saved) and the **SetScriptDialogTitle** command to change the wording of the dialog that shows while the script is running (only useful if you are creating scripts to be used by others).

If you are opening a file created by a prior version of Prism, and saved in the large format (which includes analysis results) the **RecalcAll** command will tell Prism to recalculate all the results.

If you script takes a long time to complete, you might want to use the **Beep** command to alert you when the script is complete.

If you run a script from the script dialog, every step is logged in the second tab of the dialog. In this case, the **CreateLog** command is ignored, as the log is always created. If you run a script from a file, the **CreateLog** command starts logging every step into a file with the same name as the script file, but the extension .log.

SetSheetTitle renames the sheet. If you specify K, the first K characters of the sheet name are retained, and the rest is renamed.

The **Print** command prints just the current sheet.

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The **Exit** command closes all open files, without saving and without prompting to save, and exits Prism. It works on Windows only.

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19.5 Running a Prism script

There are several ways to run a Prism script. While testing and developing a Prism script, run it from Prism. Once you perfect it, you may want to run it from the command line or from another program as explained in this section.

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19.5.1 Creating and running a script from Prism

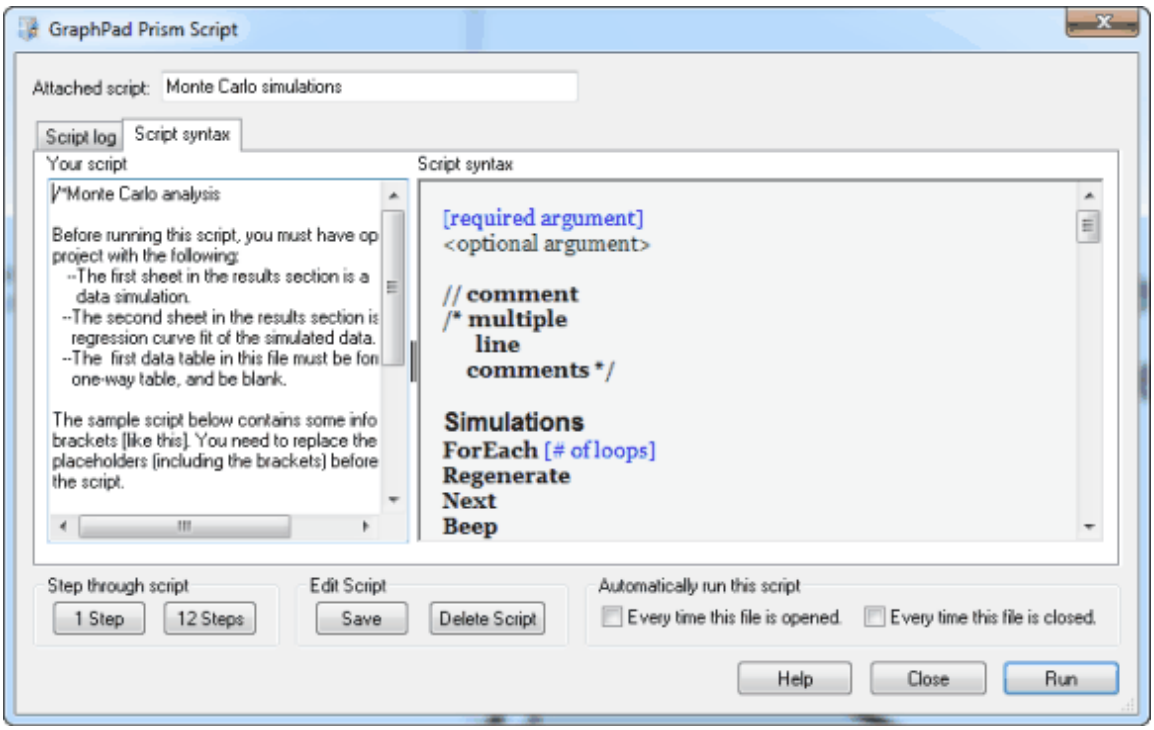
Creating and running a Prism script within Prism

While testing and developing a Prism script, run it from Prism. Once you perfect it, you may want to run it from the command line or from another program as explained later.

Creating a script

To create a script within Prism:

1. Click the Prism button (or drop file menu) and choose Run Script
2. Choose to make a new script
3. Choose to start with a blank screen, or to start with a copy of an existing script.



4. Enter or edit the script on the left side of the GraphPad Prism Script dialog. Use the right side to review script syntax.
5. Repeatedly click '1 step' to step through the script. You can watch the result in Prism, as well as observe the script log.

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6. Click "12 steps' if you are feeling lucky.
7. Click 'Run" when you are convinced the script will run without error. The Script dialog will minimize, as will Prism, while the script runs.

Editing a script

1. Click the Prism button (or drop file menu) and choose Run Script
2. Choose one of the scripts listed in the menu. Or choose Open Script file to open a script in an external file.
3. Follow steps 4 through 7 above.

19.5.2 Run a script using Automator, MacScript, or AppleScript

Run a script using Automator

If you use OSX 10.4 ("Tiger") or later, Prism installs an Automator Action that lets you launch a Prism script. The inputs to this Action is either a file containing a Prism script, or the text of the script itself. The output is either the word "Done" or an error message.

Run a script from Microsoft Office using MacScript

MacScript commands let you launch Prism from Word or Excel. These examples assume you are running Visual Basic for Applications (VBA) from within Excel.

Launch Prism with this MacScript command.

MacScript "tell application ""HD:Prism4:Prism""" + Chr(13) + _

"activate" + Chr(13) + _

"open file ""Macintosh HD:Prism4:Scripts:dr2""" + Chr(13) + _

"end tell"

The MacScript command has to specify both the full location of Prism and the script that Prism will launch. The MacScript command is a Visual Basic

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statement that you will need to write in an Excel macro, perhaps one that runs when the user clicks a button.

As soon as Visual Basic has launched Prism, it will continue to the next statement in the Visual Basic program or macro. It will NOT wait for Prism to complete before continuing. If you don't take the extra steps described below, your Visual Basic program will try to read a file containing Prism's results before Prism has finished creating that file. To avoid this, make your Visual Basic program pause until Prism creates a file.

When you write the Prism script, include lines at the end of the script to create a file that will tell Visual Basic you are done. The example below creates done.txt.

```
OpenOutput "done.txt"
WText "done"
CloseOutput
```

Your Visual Basic code should first delete the file done.txt (if it exists from a previous run) and then launch Prism. Immediately following, include these lines that make your program loop until done.txt is created.

```
Do Until Dir$("HD:prism 5:done.txt") > ""
Application.Wait Now + TimeValue("00:00:1")
Loop
```

The first line in the example above checks whether the file done.txt exists. Change the path and file name as needed. If the file exists (Prism is done), Visual Basic continues beyond the loop with any code that follows. If the file doesn't exist yet, Visual Basic waits 1 second, and then loops back to test again whether the file exists.

```
MacScript "tell application ""HD:Prism4:Prism""" + Chr(13) +
_
"quit" + Chr(13) + _
"end tell"
```

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Run a script from AppleScript

Here is a sample AppleScript that launches Prism and tells it to run the script named DR2 located in the P4scripts folder on a disk named HD.

```
tell application "HD:Applications:Prism4 Folder:Prism"
  activate
  open file “HD:P4scripts:DR2.pzc”
end tell
```

Note that are two ways to specify the path. The example above uses a HFS path. Here is the same example using a POSIX path.

```
tell application "HD:Applications:Prism4 Folder:Prism"
  activate
  open POSIX file “/P4scripts/DR2.pzc”
end tell
```

With the Posix style, you use slashes (not colons) and must have the opening slash.

19.5.3 Launching a Prism script from outside Prism (Windows)

One way to launch a script is from within Prism (drop the *File* menu and choose *Run Script*). You can also launch a Prism script from outside Prism. When you launch Prism this way, if the script closes all open Prism files, then Prism will shut down when the script ends. Otherwise Prism will remain open.

Launching a Prism script from a desktop icon

To create an icon that launches a Prism script, point your mouse to an empty spot on the desktop, click the right mouse button and select New… Shortcut. Enter a command line that starts Prism and points to the Prism

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script file to launch. Include the @ symbol in front of the path to the script name. If either path includes spaces, include the entire path in quotes as shown below:

```
"C:\PRISM5\PRISM.EXE" @"C:\PROGRAM FILES\PRISM 6\SCRIPTS\DOIT.PZC"
```

Shelling to Prism from another program

To "shell" simply means to launch one program from another. Here is an example of a shell command in an Excel VBA macro.

```
Shell ("C:\prism 5\prism.exe @C:\prism 6\dr2.pzc")
```

The shell command has to specify both the full location of prism.exe and the script that Prism will launch. Include the @ symbol in front of the script name.

Two important notes:

- Prism will run invisibly. Even when it is done, Prism will not show on screen.
- As soon as Visual Basic has launched Prism, it will continue to the next statement in the Visual Basic program or macro. It will NOT wait for Prism to complete before continuing. If you don't take the extra steps described below, your Visual Basic program will try to read a file containing Prism's results before Prism has finished creating that file. To avoid this, make your Visual Basic program pause until Prism creates a file, as explained below.

When you write the Prism script, include lines at the end of the script to create a file that will tell Visual Basic you are done. The example below creates done.txt.

```
OpenOutput  "done.txt"
WText "done"
CloseOutput
```

Your Visual Basic code should first delete the file done.txt (if it exists from a previous run) and then launch Prism. Immediately following, include these lines that make your program loop until done.txt is created.

```
Do Until Dir$("C:\prism 6\done.txt") > ""
Application.Wait Now + TimeValue("00:00:1")
Loop
```

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The first line in the example above checks whether the file done.txt exists. Change the path and file name as needed. If the file exists (Prism is done), Visual Basic continues beyond the loop with any code that follows. If the file doesn't exist yet, Visual Basic waits 1 second, and then loops back to test again whether the file exists.

Launching Prism from another program using OLE automation

An alternative to the Shell command is to launch Prism using OLE (or Active X) automation. Here is an example.

```
Set Prism = CreateObject("Prism.command")
Prism.SetPath (”C:\data\july99”)
Prism.visible
Prism.runcommand (“c:\prism5\doseresp.pzc")
Prism.quit
Set Prism = Nothing
```

The first line creates a Prism command object. You may give the object variable any name you like (on the left side of the = sign), but it is convenient to name it Prism. You don’t have to tell the program the location of prism.exe. Windows takes care of this automatically via the registry.

The second line, which is optional, tells Prism which folder to use. This replaces the need for a SetPath statement within the Prism script. When running a script, Prism looks for data files and templates in this directory (folder) first. Place the name of the folder in quotation marks or use a text variable.

The third line tells Prism to show its progress dialog. Once you have tested your code, remove this line so Prism will run invisibly (show no dialogs).

The fourth line launches the Prism script. You must include the full path of the script file; the directory used in the SetPath message (above) is not used automatically.

The final two lines cause Prism to exit, and free the memory used by the Prism object.

Shell command vs. VBA automation

There are two advantages to using OLE automation, rather than the Shell statement. First, with OLE automation Visual Basic and Prism run

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sequentially, with no possibility of Visual Basic trying to obtain results that haven't been created yet. Second, with OLE automation, your Visual Basic program can direct Prism to import data from a particular folder (Prism.SetPath command) without changing the Prism script.

Launching a script from an intranet web page (Windows)

You can launch Prism from a link on an intranet web site.

First, create a batch file on your web server that calls (using the Call command) the program and individual configuration files.

For example, create a file called StartPrism.bat containing a single line something like this

```
Call "N:\Program Files\PRISM5\PRISM.EXE" -OC:\WINDOWS\prism5.cnf
```

Or this:

```
Call F:\Prism\Prism.exe @"F:\PRISM\PRISMSCRIPTS\DOIT.PZC"
```

Of course, you'll need to adjust this example depending on where you have installed Prism. The drive letters are aliases for the server drive. In the first example, the first part opens Prism and the second part tells Prism where to find the configuration file. In the second example, the second part launches a Prism script.

Next edit your web page to include a hyperlink to the batch file. For example, HTML link the text "Prism" to the file StartPrism.bat

19.5.4 Using Prism scripts with Excel

Exporting data from Excel to Prism

Although Prism can open Excel files, this is slow. Instead, write a Visual Basic macro to export selected values as a text file. The macro below, run from Excel, exports the upper left corner of worksheet 1 (12 rows, 6 columns) to a comma-separated value (CSV) file, which Prism can import.

Open "C:\data\july97\dr2.csv" For Output As #1

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```
For I = 1 To 12
For J= 1 to 6
  Print #1, Worksheets(1).Cells(I,J).Value; ",";
Next
Write #1,
Next
Close #1
```

Follow this with code to launch Prism, run the Prism script, and perhaps import results from Prism back to Excel.

Creating a PZC (Prism script) file from Excel

While creating a system to run Prism from Excel, you need to edit both the Excel VBA statements and the Prism PZC script. One way to simplify your work is to write Visual Basic code that exports the PZC file from Excel. Then you only have to edit one file. For example, you could use the following VBA code:

```
Open  "C:\Prism4\auto.pzc" For Output As #1
Print #1, “Shortlog”
Print #1, “SetPath C:\gp\prism25\”
Print #1, “Open generate.pzm”
Print #1, “openOutput fit.txt”
Print #1, “   ForEach 500”
Print #1, “    GoTo R 1”
Print #1, “    Regenerate”
Print #1, “    GoTo R 2”
Print #1, “    WCell 5,1”
Print #1, “ Next”
Close #1
Shell ("C:\program files\prism5\prism.exe  @C:
\prism5\auto.pzc")
```

The first line starts a new file called auto.pzc and designates it as file number 1. The next 10 lines, export Prism script commands you have written into that file. The next line closes the script file, which is launched by the final line shown above. Further lines would import the results exported by Prism.

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Putting all the commands into one file doesn't help conceptually. You still have to distinguish the VBA code within Excel from the script commands of Prism. The advantage is that you can do all the editing within one file, rather than two. The disadvantage is that writing the script is a bit harder, as you have to place each line in quotations and precede it with "Print #1,".

Putting Prism graphs into Excel

In addition to importing the results of Prism analyses, you may want to import a Prism graph into Excel. Exporting the graph is no problem, as a Prism script can export a graph or layout as a WMF picture. The problem is importing it into Excel, as there is no way to write Visual Basic commands to import a picture. You can do it indirectly. Create a picture object manually in Excel (display the control toolbar, click on the image button, then drag to create the object). Then write Basic code to change the contents of that picture object. For example,

Sheet2.DRGraph.Picture = LoadPicture(Path$ + "dr2.wmf")

19.5.5 How long can a script be?

The maximum size of a script is not limited by number of lines, but rather by number of characters. The limit is 64,000 characters. If you hit this limit, consider removing comments and blank lines. Also consider removing any parts of the script that are not needed. For example, most script commands have default parameters and if these are correct, you don't need to hard code parameters.

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20 Standardizing Prism use in a lab

If many people in your lab use GraphPad Prism, you may want to standardize some preferences or provide all with a set of templates or equations or color schemes. This section explains how to do so.

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20.1 Locking the preference file

What is included within the preferences file?

Prism offers many choices on its Preference dialog. It allows you to set defaults for color schemes, fonts, symbols sizes, graph units, and more. Beyond that, the Prism Preferences file remembers which files you have recently opened or closed, user-defined equations you have created, color schemes you have created, autocomplete text, and more. All that is saved in a preference file that customizes Prism for you.

Where is the preference file located?

Windows XP:

```
[system disk]:\Documents and Settings\[user] \Application data\GraphPad Software\Pri
```

Vista and Windows 7-10:

```
[system disk]:\Users\[user]\AppData\Roaming\GraphPad Software\Prism\8.0\Prism8.cfg
```

Mac:

```
~[local user]\Library\Preferences\ com.GraphPad.Prism.plist
```

With older versions of OSX, you can locate the file using Finder and drag it to the trash. Since Lion, the file is invisible. To delete it, launch the Terminal application, and enter this command:

rm ~/Library/Preferences/com.GraphPad.Prism.plist

How to prevent saving changes to the preferences file: Windows

When Prism is used in a teaching lab, you want Prism to startup the same way each time. When a student uses Prism, you don't want preferences set by other students to be used, as that would make it seem that Prism acts unpredictably.

The first step is to create and write-protect the preference file.

1. Delete the Prism preference file, Prism8.cfg from:

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[system disk]:\Users\[user]\AppData\Roaming\GraphPad Software\Prism\8.0

2. Launch Prism so it creates a default preference file.

3. Set any preferences as you want them to appear for each user.

4. Create any color schemes you want everyone to have access to, as well as user-defined equations you want everyone to access.

5. Quit Prism. Now the preference file is saved.

6. You might wish to write-protect the preference file to make sure it isn't changed in the future.

The second step is to add /C to the Prism command line 661, to tell Prism not to resave the preference file when it exits.

Individual users will still be able to make changes to the Preference file, and these will be used during that session. But those changes won't get saved and so won't be seen by the next user.

How to prevent saving changes to the preferences file: Mac

When Prism is used in a teaching lab, you want Prism to startup the same way each time. When a student uses Prism, you don't want preferences set by other students to be used, as that would make it seem that Prism acts unpredictably.

The method explained above for Windows doesn't work, because there are no command line switches in OSX. Instead, create and write-protect the preference file.

1. Delete the Prism preference file, com.GraphPad.Prism.plist, from:

   ~[local user]:Library:Preferences

2. Launch Prism so it creates a default preference file.

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3. Set any preferences as you want them to appear for each user. Also create any color schemes or user defined equations you want everyone to access.

4. Quit Prism.

5. Write protect the preference file:

Open the folder that contains the preference file

: ~[local user]:Library:Preferences

Beware that Macs have multiple Library folders. Pick the one within the local user that each student will log in as, not the overall Library folder.

Right-click on the file "com.GraphPad.Prism.plist", and choose Get Info. Check "Locked".

Repeat for the file that contains the list of autocomplete text entries: com.GraphPad.Prism.autocomplete.plist

20.2 Individual preference files

Prism stores the list of user-defined equations, choices from the Preferences 191 dialogs, the list of recently used files, and more in a configuration file.

Prism Windows stores preferences in the file Prism8.cfg. Prism Mac stores preferences in a file named “Prism6 Preferences”. The location of these files depends on which version of Windows or the Mac OS you use, so search for them.

If several people use the same Windows computer, each may wish to maintain their own preferences and equations. To do this, create a different shortcut icon for each user. In the target portion of the properties dialog for the shortcut, enter the full path name of the Prism program followed by “-O” (letter O, not zero) and then the full name of the configuration file you want to use. If the file doesn't exist, Prism will create it. For example:

```
C:\Program Files\PRISM8\PRISM.EXE -OC:\JERRYS\JSPRISM.CNF
```

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If you are running a network license, you may place the Prism6.cfg file into the program folder on the shared (server) drive. When Prism is first used on a new computer, it will use the settings in this shared configuration file. Changes will be saved on the individual user's hard drive. This means that all users can begin with the same settings, but then customize them..

20.3 Shared templates, methods, and examples

You can ensure that everyone using Prism sees the same templates, methods and examples. Create them on one computer, and then move the files to the other computers you manage. To do that, you need to know where the files are stored.

Templates

Templates are complete Prism files that you'll see listed on the Open File tab of the Welcome (File..New) dialog. You can tell Prism where to save templates in the File Locations tab of the Preferences dialog. The default locations are listed below.

Prism saves templates in:

```
[[system disk]:\ProgramData\GraphPad Software\Prism\8.0\Templates\[templates categor
```

Prism Mac saves these files in:

```
Users/[User]/Library/Application Support/GraphPad/Prism/8/Templates/[templates categ
```

Methods

A method file contains a data table and linked analyses and graphs. When you apply a method, using the Wand (Wizard to Analyze Data), those analyses and graphs are attached to a new data table.

Prism saves methods in:

```
[system disk]:\ProgramData\GraphPad Software\Prism\8.0\Methods\[methods category fol
```

Prism Mac saves these files in:

```
/Library/Application Support/GraphPad/prism/8/Methods/[methods category folder]
```

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Examples

An example file is a Prism graph with linked data and analyses. You clone 173 an example from the Clone A Graph tab of the Welcome dialog.

Saved examples

Prism Windows XP saves examples in:

```
[system disk]:\Documents and Settings\[User]\Application Data\GraphPad Software\Pris
```

On Vista or Windows 7, Prism saves examples in:

```
[system disk]:\Users\[User]\AppData\Roaming\GraphPad Software\Prism\8.0\Examples\[ex
```

Prism Mac saves these files in:

```
/Users/[User]/Library/Application Support/GraphPad/prism/8/Examples/[examples catego
```

Shared examples

The Welcome (File..New) dialog cloning tab offers a separate tab for shared examples. These are intended to be examples created in a lab to be shared with everyone in a lab. The only way to show graphs on this tab is to manually move filed from the saved example folder to the shared example folder.

On Windows XP, Prism looks for shared examples in:

```
[system_disk]:\Documents and Settings\All Users\Application Data\GraphPad Software\P
```

On Windows Vista or Windows 7, Prism looks for shared examples in:

```
[system_disk]:\Users\All Users\GraphPad Software\Prism\8.0\Examples\
```

Prism Mac looks for shared examples in:

```
Library/Application Support/GraphPad/prism/8/Examples
```

Prism Mac also looks for shared examples within the application bundle:

```
[Prism.app]/Contents/SharedSupport/Examples
```

Providing online Help for methods and templates

When you save the template or method, enter a brief description. If you want to provide more extensive help to your users, also create a web

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(.htm) file that explains use of the template or method. Give it the same name as the template or method, but with the extension .htm, and place it in the same folder. For example, if your template is doseresponse.pzt, create a help file named doseresponse.htm. When someone uses the template or method, Prism will pop up the dialog with the brief instructions. This dialog also has a button “Help for this template”. When your uses click this button, Prism will launch a web browser to display the .htm file you created.

20.4 Adding your own built-in equations

Prism makes it easy to add your own equations, and these will appear in the "User defined equations" group of equations. But if you want to share a set of user-defined equations with others in your lab, you can create a new group of equations that will appear underneath the ones we provide.

How to create new Equation files:

1. Start a new Prism project. Go to preferences, file and printer tab, and make sure that you are saving in .pzf format and that the "Save compact" option is not checked.

2. For each equation, either fit a data set with nonlinear regression or simulate a theoretical curve (plot a function). Reorder the results pages to the order you want the equations displayed in the equation list.

3. If a user picks your equation and clicks 'Details' they will see a small preview of the graph that is linked to the equation. Make sure this graph is easy to comprehend at small sizes.

4. When entering each equation, also consider entering a description and tip. The tip appears on the Fit tab of nonlinear regression. The description appears on the Details page.

5. When saving your equation, use a name something like this: "[Smith Lab] Flow cytometry equations", so it is very clear to anyone using

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Prism that these equations did not come from GraphPad (we won't be able to answer questions about them).

6. Note that each file you create will become a "folder" of equations in Prism. You'll want each file, therefore, to include several equations.

How to make those equations appear with the list of built-in equations:

- Windows: Move (or save) the files to the Equations folder within the Prism program folder.

- Mac: Find the Prism.app file. Right (or control) click and choose Show Package Contents. You'll see the "folders" within the package. Drill down to Contents: SharedSupport:Equations. Move your equation files there. Note that by changing the prism.app file (bundle) you have changed its digital signatures. So you'll need to configure Gatekeeper to let Prism run anyway.

- Both platforms: Please do not delete any equation files that came with Prism. They are "built in" so should always be available (to prevent confusion later).

If Prism is running, quit (exit) it, then restart it. You'll now see your list of equations in the Fit tab of nonlinear regression.

Editing those equations is a bit tricky. Quit Prism, and move the file out of the Equations folder. Now restart Prism, open the file and edit it. When done, save your changes and quit Prism. Finally, move the file back to the Equations folder, and restart Prism.

Don't worry about .pze files

For every "built-in" equation file, Prism creates a .pze file. These files contain, essentially, compiled equations and so let Prism load the equations more quickly. With Windows, you'll find these deep in the Application Data folder. With Mac, they are deep in the Application Support folder and also in the Cache folder in the Equations folder in the Prism bundle.

You don't need to manage these files, and shouldn't try to. Prism will automatically create and update the needed file when necessary.

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20.5 Using a local LabArchives server

LabArchives usually uses a server maintained by LabArchives.

If you want to use a local server to host LabArchives files, you can do so. Details here.

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21 Support and license

Prism makes it easy to get the support you need. This section tells you about the Prism license agreement and how to contact our support department.

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21.1 Installing Prism

Installing for one person

Installing Prism is standard and easy.

On Windows, simply run our .MSI installation program by double-clicking on the file. The single installer will install either the 32- or 64-bit version of Prism depending on which version of Windows you use.

On a Mac, drag the Prism application file to your Applications folder.

Installing for many people

We offer some shortcuts to help IT people installing Prism for many. Read the details in this document:

Installing GraphPad Prism 8 for Many - A guide for IT staff

21.2 System Requirements

Prism 8 for Windows

- Runs under either the 32- or 64-bit versions of Windows Vista, 7, 8 or 10. The installer will detect your version of Windows and install the 32- or 64-bit version of Prism accordingly.
- Requires a display resolution of at least 800 x 540 pixels. So the lowest standard display resolution for Prism is 800 x 600.
- Requires about 100 MB (megabytes) of space on the hard drive.
- Must connect to the internet to verify the license when it is first activated and also at at least once every 30 days (or every 20 launches, whichever comes sooner).

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Prism 8 for Mac

- Runs under macOS X 10.9 (Mavericks) or later. If you use macOS 10.8, Prism will launch and seems to run OK, but we haven't tested Prism thoroughly under this version of macOS and can't provide much support. If you use 10.8, we urge you to update MacOS.
- Requires a display with a resolution of at least 1024 x 768 pixels.
- Requires about 130 MB (megabytes) of space on the hard drive.
- Must connect to the internet to verify the license when it is first activated and also at at least once every 30 days (or every 20 launches, whichever comes sooner).

21.3 Fire wall settings

Prism tries to connect to the internet with every launch, and must succeed at least every 30 days or 20 launches (whichever comes first) to conform the validity of the license. Once it hits those limits, it displays:

"You are currently offline. Prism must connect to the internet at least once every 30 days to validate your license. Please connect to the internet and launch Prism again."

If you are getting this message even though you computer is connected to the internet, perhaps you have a firewall that prevents Prism from communicating with the internet. Prism uses port 443, which is the same port that web browsers use when browsing securely (https:), but it is possible that your IT people configured your firewall so that web browsers (and email programs...) but not Prism can use that port. If that is the case, they will need to change the firewall settings.

21.4 Command line switches (Windows only)

When Prism starts up, you can give it some special instructions in the command line. In order to add command line instructions, edit the Prism.exe start icon. Right click on the Prism desktop icon and In Properties change the target to add the command after the last quote

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mark. Leave a space between the quote mark and the slash, so the target looks like this:

```
"C:\Program Files\GraphPad\Prism8\prism.exe" /U
```

You can use hyphens or slashes (-U and /U) interchangeaby.

All of the options shown below also work if you use the Shell command to launch Prism from another program using Visual Basic for Applications (VBA).

These options only work on Windows. There is no similar mechanism for sending startup commands to Mac applications.

Run prism script - @[some_prism_script_file_path]

To create an icon that launches a specific Prism script, point your mouse to an empty spot on the desktop, click the right mouse button and select New… Shortcut. Enter a command line that starts Prism and points to the Prism script file to launch. Include the @ symbol in front of the path to the script name. If either path includes spaces, include the entire path in quotes as shown below:

```
"C:\Program Files\GraphPad\Prism5\prism.exe" @"c:\program files\GraphPad\Prism8\scri
```

Turrning off check for update - /U

When Prism (Windows) first starts, it tries to check for updates via the web. If it can't connect, it normally just keeps going. But in very rare cases, it tries to check for updates and then can't get past this step so never gets to the Welcome dialog. This is quite rare, but easy to work around. One way to get Prism to stop check for updates is to use the /U switch when starting Prism.

Edit the Prism start icon so that the target looks something like this (with quotes around the path, but not around the /U, and a space beteween the quotation mark and the slash):

```
"C:\Program Files\GraphPad\Prism8\prism.exe" /U
```

Create log - /L

If Prism will not start at all, it can help to create a start log. This will show us which steps Prism completes successfully and which steps fail. To

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create a log, edit the Prism start icon to add the /L switch so the target looks looks something like this (with quotes around the path, but not around the /L, and a space between the quotation mark and the slash):

```
"C:\Program Files\GraphPad\Prism8\prism.exe" /L
```

Regenerate PZE files (prism equations cache) - /E

The "built-in" equations are actually installed as a set of Prism files. You can even add your own "built-in" equations. The first time Prism runs, it compiles these equations to a form (.PZE files) that it can access and compute very quickly. It should never be necessary, but you can force Prism to compile all the equations again. To do so, edit the Prism start icon to add the /E switch so the target looks something like this (with quotes around the path, but not around the /E, and a space between the quotation mark and the slash):

```
"C:\Program Files\GraphPad\Prism8\prism.exe" /E
```

Print file - /P [file_path]

You can create an icon that will open a Prism file and print all pages. Edit the Prism start icon to add the /P switch so the target looks like this. Please note space between /P and [file_path]. Prism prints silently, without Prism appearing in the taskbar.

```
"C:\Program Files\GraphPad\Prism8\prism.exe" /P c:\test.pzf
```

Use custom option file - /O [prism_cfg_file_path]

Prism stores many settings in a preference file (also called an options file). This file contains all the settings in the Preferences dialog, a list of recently used files, user-defined equations, color schemes and more. You can use a startup option to force Prism to access the preferences file from a different location. This might be useful if you use Prism for several very distinct uses, and want a separate set of preferences for each. It would also be useful if different people use Prism, and each wants unique preferences, but they all want to log in to Windows as the same User. To tell Prism to use a unique preference file, edit the Prism start icon to add the /O switch so the target looks like this. Please note the space between /O and [file_path].

```
"C:\Program Files\GraphPad\Prism8\prism.exe"  /O c:\gsconfig.cfg
```

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Don't save preferences - /C

Prism stores many settings in a preference file (also called an options file). This file contains all the settings in the Preferences dialog, a list of recently used files, user-defined equations, color schemes and more. You can use a startup option to tell Prism to not save any changes to the preferences file. This is useful in a teaching lab, or a shared computer, so Prism will always start with the same preferences.

```
"C:\Program Files\GraphPad\Prism8\prism.exe" /C
```

21.5 Technical support

Check for program updates

Like all software companies, GraphPad occasionally issues minor updates to Prism. The full version number is not on the CD. Instead, drop the Help menu and choose 'Check for updates'.

Check for answers on graphpad.com

If you can't find the answers in these help screens, please visit our support web site. We update the Quick Answers database almost every week, and the answer to your question is very likely to be there.

Personal support

Drop the Help menu and choose Personal support command. Prism will instruct your email program to create a new email, automatically including your version and serial number, and attaching (if you choose) the file you are working on.

If the Personal support command does not work on your computer (or you use a Mac) email us at support@graphpad.com .

Please send:

- The version of Prism you are running and if you are using Prism for Windows or for Mac. To find the version number, drop the Help menu (Windows) or Prism menu (Mac OS X) and choose About Prism.

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Windows versions have two digits after the decimal point (i. e. 8.01). Mac versions have a single digit after the decimal followed by a letter (i. e. 8.0b). Send us the actual version number (which you can see on the Welcome dialog when you start Prism. Don't say something ambiguous like "Prism 8" or "the latest version".

- In most cases, a problem is best demonstrated by attaching a particular project (.pzf) file to your email. Please make the project small and focused. If you are having a problem with one graph, send us a project with one graph, not 100.

- If you saw an error message, send us a screen shot or the exact wording you saw.

- Send screen shots when that would help us understand the problem.

- Don't send raw data in the text of the email and expect us to paste this into Prism, reproduce what we think you might have done, and then comment on what we see which may or may not be what you see. Similarly don't send data in Excel files.

We provide support for Prism, not statistical consulting

Your Prism license does not include free statistical consulting. Since the boundary between technical support and statistical consulting is often unclear, we often will try to answer simple questions about data analysis. But don't push your luck! While we are often willing to look over a completed analysis to offer our thoughts, we won't analyze your data for you.

No phone support

We've discovered that we can provide much better support by offering it via email only. We know that some companies use "email only" as a way to brush off customers and avoid providing support. We are not like that. We really do provide individual, helpful answers to your email questions, often within an hour or two.

GraphPad doesn't offer telephone support for several reasons.

- Our customers live all around the world, but we're only here during business hours on the West coast.

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- When we return your phone call, you might be at lunch, away from your desk, or gone for the day. If we leave a message, it might start a round of telephone tag that could last for days.

- We often consult with contract programmers in a different country before answering questions.

- It is difficult to describe graphing and analysis problems on the telephone. When you email us a question, you can attach your Prism files, exported images, or screenshots of error messages. This helps us figure out the problem and provide helpful solutions.

- In many cases, our answers contain screen shots or links to pages on our web site. Trying to relay a URL via telephone doesn't work very well.

- We keep a record of problems and solutions. When you receive a email from us, you can always refer back to it -- even weeks or months later. And we can keep a record of the questions you asked and whether or not we solved your problems. We use these records to help others with similar questions, and to help design new versions of our software.

- We often answer emails while traveling or from home. This lets us answer much more promptly than we could by phone.

21.6 How to cite GraphPad Prism

Citing Prism

When citing analyses performed by the program, include the name of the analysis, and Prism version number (including the second number after the decimal point). Use this example as a guide:

> "One-way ANOVA followed by Dunnett's multiple comparisons test was performed using GraphPad Prism version 8.0.0 for Windows, GraphPad Software, San Diego, California USA, www.graphpad.com".

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To find the full version number, pull down the Help menu (Windows) or the Prism menu (Mac OS X). Then choose About Prism.

It is more important to explain which analysis choices you made than which program you used. For example, it doesn't really help to say you fit a curve with Prism if you don't say which equation you selected, how you chose to weight data points, whether you fixed any parameters to constant values, etc.

Citing a page in the user's guide or an FAQ

Include the name of the page, the date you accessed it and the URL. Use this example as a guide:

> "What you can conclude when two error bars overlap (or don't)?" GraphPad Software, Inc. Accessed 5 November 2008. http://www.graphpad.com/faq/viewfaq.cfm?faq=1362

Citing the QuickCalc free web calculator

Include the name of the calculator and the date you used it. Here is an example:

> Confidence intervals of proportions were calculated using the GraphPad QuickCalcs Web site: http://www.graphpad.com/quickcalcs/ConfInterval1.cfm (accessed November 2015).

21.7 GraphPad Prism license agreement

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Email jimmy@startrain.com, or call 415-893-1835.

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