SigmaPlot Whitepaper

Data Transformations in Biology Using SigmaPlot

Introduction

Many variables in biology do not meet the assumptions of parametric statistical tests: they are not normally distributed, the variances are not homogeneous, or both.

Using a parametric statistical test (such as an ANOVA or linear regression) on such data may give a misleading result.

In some cases, transforming the data will make it fit the assumptions better. There are an infinite number of transformations you could use, but it is better to use a transformation that is commonly used in your field , such as the square-root transformation for count data or the log transformation for size data, than an ambiguous transformation that not many people have heard of.

It is also important that you decide which transformation to use before you do the statistical test.

Mathematical transformations on variables are often performed in order to:

- increase the closeness o f the fit (increase R-square) between a regression equation and the data points,

  and/or to

- make the variables fit the assumptions of statistical procedures, such as normality, and thereby derive the full power of those procedures.

In addition, transformations of certain types of variables can sometimes make interpretation of the results of statistical procedures easier and more insightful than without the transformations.

The term "ladder of powers" refers to a sequence of algebraic transformations that may be performed on a variable to change the shape of its distribution .

Ladder of Powers

Exponent	Algebraic Form	Function
...	...	...
2	Y^2	Square
1	y	Raw Data
1/2	$\sqrt{y}$	Square Root
"0"	Log(y)	Logarithm
-1/2	$-1/\sqrt{y}$	Reciprocal Root
-1	$-1/y$	Reciprocal or Inverse
...	...	...

The ladder as shown in the above table is shown here for a variable labeled "y" which could be a dependent or independent variable.

Other powers and roots fit into the rows between the ones shown and extend both above and below the table.

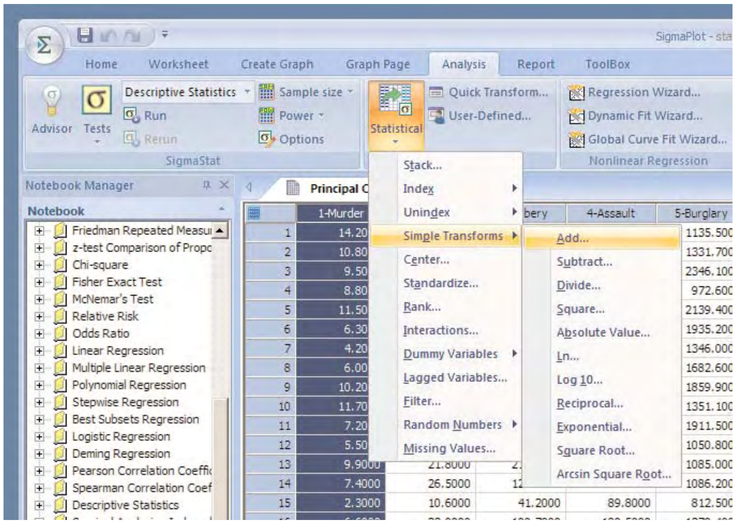
There are many transformations used in biology. The most commonly used are:

- Square-root transformation. This consists of taking the square root of each observation

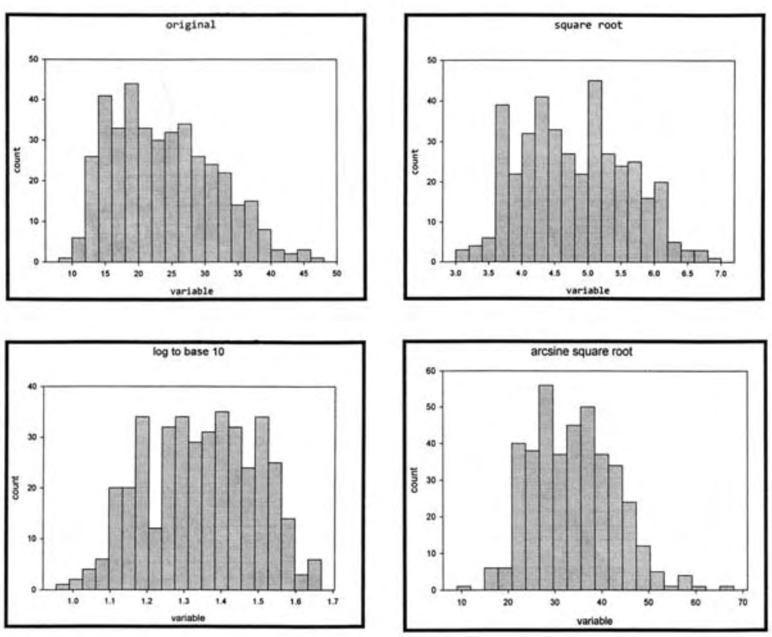
- ❑ Log transformation. This consists of taking the base-10 log of each observation
- ❑ Arcsine square root transformation. This consists of taking the arcsine of the square root of a number.

Transforms in SigmaPlot

The path to transforms in newer versions of SigmaPlot is shown below:



Some of the histograms of transforms according to ladder of powers using SigmaPlot is shown below along with the histogram of the original data:



Grafiti

North America & South America
Grafiti LLC
405 Waverley St
Palo Alto, CA 94301
United States
saves.sales@grafiti.com

Germany, Austria, & Eastern Europe
Grafiti GmBH
Königsallee 92a
40212 Düsseldorf Germany
saveskontakt@grafiti.com

UK & Western Europe
Grafiti UK Ltd
268 Bath Road Slough, SLI 4DX
UK
saves.sales@grafiti.com