Multi-Vari Chart

Summary

A **Multi-Vari Chart** is a chart designed to display multiple sources of variability in a way that enables the analyst to identify easily which factors are the most important. It is commonly used to display data from a designed experiment prior to performing a formal statistical analysis.

Sample StatFolio: *multivari chart.sgp*

Sample Data:

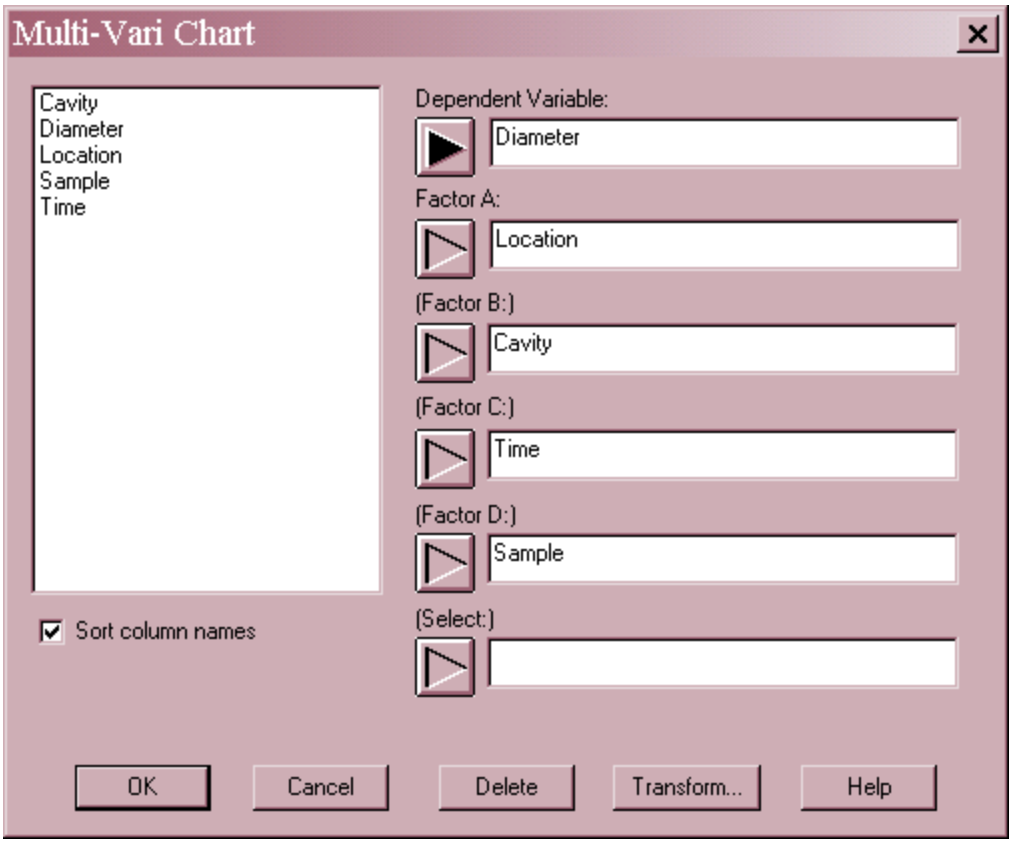
The file *injection.sf6* contains data from an injection molding process. In the study, measurements were made of the diameter at 3 locations on each of 2 samples from 4 cavities at 3 different time periods. The table below shows a partial list of the data in that file:

Sample	*Location*	*Time*	*Cavity*	*Diameter*
1	A	1	1	0.3222
1	A	1	2	0.3201
1	A	1	3	0.3210
1	A	1	4	0.3189
1	A	2	1	0.3218
1	A	2	2	0.3198
1	A	2	3	0.3216
1	A	2	4	0.3194
1	A	3	1	0.3224
1	A	3	2	0.3188
1	A	3	3	0.3211
1	A	3	4	0.3190
1	B	1	1	0.3223
1	B	1	2	0.3197
1	B	1	3	0.3207
1	B	1	4	0.3181

The file has a total of $n = 72$ measurements.

Data Input

The data to be analyzed consists of a single column containing the measurements and multiple columns indicating the levels of the experimental factors.



- **Dependent variable:** numeric column containing the observations.
- **Factor A**: column containing levels identifying the first factor. This factor defines the point symbols on the chart.
- **Factor B**: column containing levels identifying the second factor, if any. This factor defines how points are grouped on the chart.
- **Factor C**: column containing levels identifying the third factor, if any. This factor defines horizontal divisions on the chart.
- **Factor D**: column containing levels identifying the fourth factor, if any. This factor defines vertical divisions on the chart.
- **Select**: subset selection.

Analysis Summary

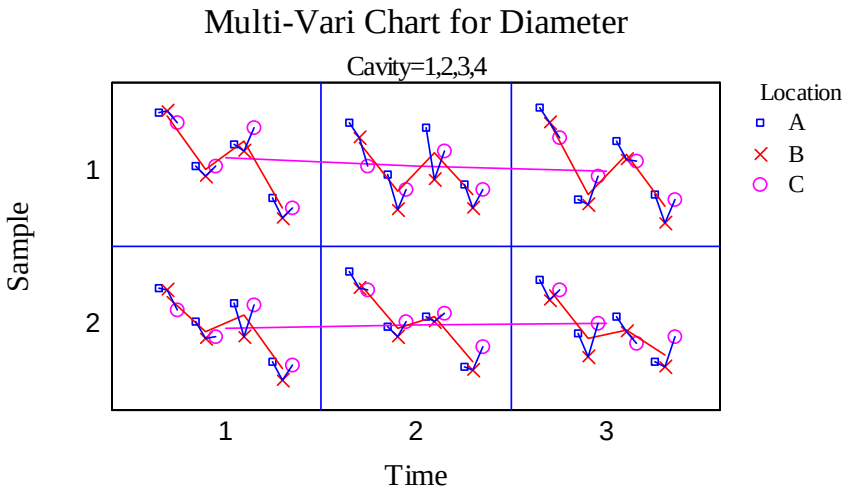
The *Analysis Summary* shows the number of observations and the names of the experimental factors.

Multi-Vari Chart
Dependent variable: Diameter
Factors:
A=Location
B=Cavity
C=Time
D=Sample

There are 72 complete cases in the plot.

Multi-Vari Chart

The *Multi-Vari Chart* for four factors has the following form:

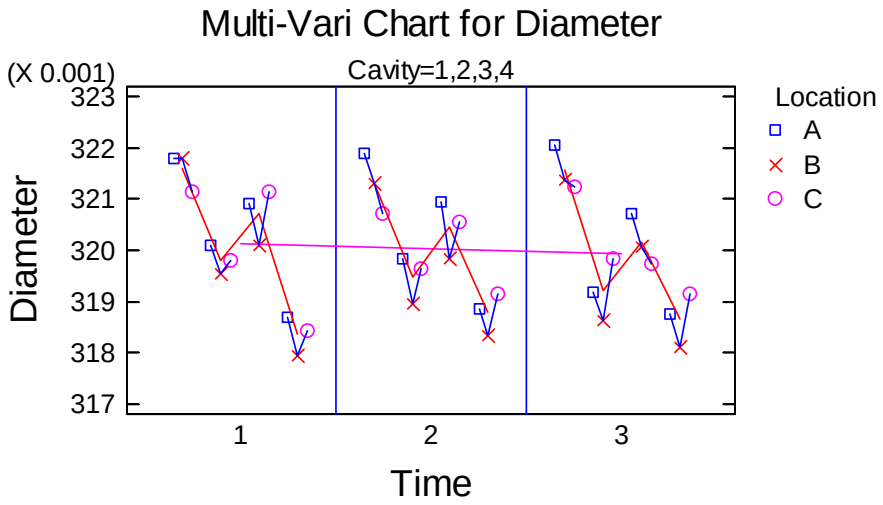


A row of plots is displayed for each *Sample*, with *Time* increasing along the horizontal axis. Each section of the plot shows the measured *Diameter* at three locations on *Parts* from each of the four *Cavities*. Lines connect:

- the measurements at the 3 *Locations* on each *Sample*.
- the average measurement on each *Cavity* for each *Sample-Time* combination.
- the average measurement in each row at each of the 3 *Times*.

Notice that most of the variability is coming from differences between *Cavities*, with *Location* contributing some variability. On the other hand, the effect of *Time* appears to be quite small.

If *Sample* is removed as a factor, the chart takes a slightly different format:



Each plotted point is now the average of the two *Samples* plotted previously. If more factors are removed, the data is averaged over all levels of the removed factors.