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Inside This Newsletter

JMP software helps you visualize and uncover data patterns that have an impact on research, development, and production activities. JMP is used worldwide to develop products, reduce defects, streamline operations, improve quality, and optimize resources. Universities on every continent rely on JMP to make teaching and learning statistics relevant and fun.

jmp

Robust Process Engineering

By Bradley Jones, SAS Institute

Robust process engineering enables you to produce acceptable products reliably, despite variation in your process variables. After a process has been modeled, the Prediction Profiler is often used to find the best factor settings based on the given desirability of response values. However, matching the target responses is only part of the goal. You also want to minimize variation. The example in this article shows how to use DOE, the Prediction Profiler, and simulation capabilities in JMP to match a response target while minimizing response variation.

Suppose your process has factors that you can control in an experiment, but are subject to random variation in manufacturing. Such factors are sometimes called *noise factors*. The noise factors induce transmitted variation. Transmitted variation refers to the effect on the response of unavoidable variation in some factors.

This example uses the data table shown in *Figure 1*. The model has two control factors, c1 and c2, two noise factors, n1 and n2, and all the 2nd-order interactions. You want to find factor settings that minimize the defect rate defined by the spec limits and the target. The data table shown in *Figure 1*, Robust Design Data.jmp, is available on the companion web site for this issue of JMPer Cable, found at www.jmp.com

Figure 1 Example Design Table with Response Values

Robust Design Data.jmp

Robust Design Data.jmp
Design Custom Design
Criterion D Optimal
Model

Columns (8/0)
c1 *
c2 *
n1 *
n2 *
d *

Rows
All rows 12
Selected 0

	c1	c2	n1	n2	d
1	1	1	-1	1	6.55
2	-1	-1	-1	1	75.83
3	1	-1	-1	-1	81.41
4	-1	1	-1	1	68.09
5	1	-1	1	-1	73.83
6	1	1	1	1	29.6
7	1	1	1	-1	56.16
8	1	-1	-1	1	23.6
9	-1	-1	1	1	34.26
10	-1	1	1	1	57.73
11	-1	-1	1	-1	49.59
12	-1	1	-1	-1	52.88

A desirable response d is centered at the target of 45, between limits of 40 and 50. The response has Response Limits and Spec Limits as shown in *Figure 2*. The Distribution platform will use these limits to perform a capability analysis that evaluates defect rate.

Figure 2 Column Properties for the Response Column d

Column Properties

Response Limits
optional item

Remove

Response Limits

Response Limits are bounds on a response's range of acceptability. The prediction and contour profilers use these values. Click below to key in values.

Match Target

Importance 10

	Add	Desirability
Lower	40	.
Middle	.	.
Upper	50	.

Column Properties

Response Limits
Spec Limits
optional item

Remove

Spec Limits

Spec Limits are specification limits that trigger a capability analysis in the Distribution platform. Click below to key in values.

Lower Spec Limit	40
Upper Spec Limit	50
Target	45

The Model script included with the data table runs the model. After running the model, use the Contour Profiler (*Figure 3*) to see a contour line of all the combinations of c1 and c2 values that achieve the target, given the current values of the noise factors.

For the target of 45 and limits of 40 and 50, the line, labeled d, shows the range of c1, c2 settings that hit the target. The unshaded area shows the factor space that is within specifications. In this example, c1 is arbitrarily set to 0.75. Then c2 = –0.319 results in a value close to the target of 45. Again, any point on this curve matches the target for d, on average.

Next, use the Simulator, found in the menu on the Contour Profiler title bar, to evaluate the effectiveness of these factor settings for the given spec limits and target.

The Simulator panel shown in *Figure 3* appears with the settings copied from the Contour Profiler. You specify that the noise factors, n1 and n2, are random normal with mean 0 and standard deviation 0.4 and add random noise to the response. The simulator then creates a new table with 1000 simulated runs.

The new table appears with a script that runs the Distribution platform complete with a capability analysis, as shown in *Figure 4*. You can see in the Capability Analysis report that the estimated defect rate (Total Outside) is 55.7 percent. Over half the products are outside the specification limits.

That is not acceptable.

Figure 3 Contour Profiler with Simulator for Model

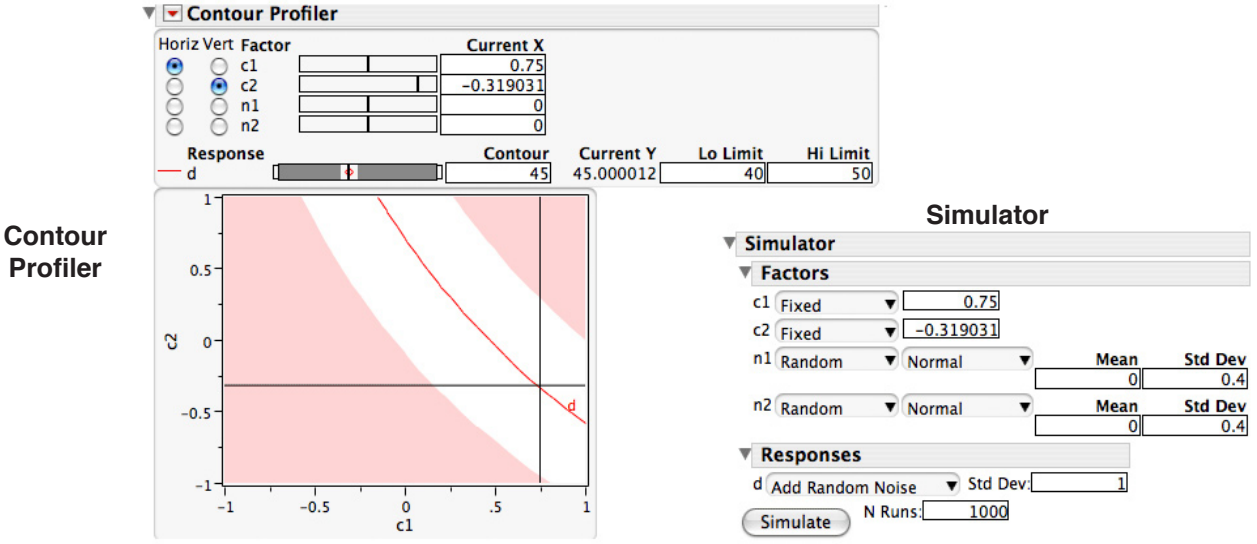
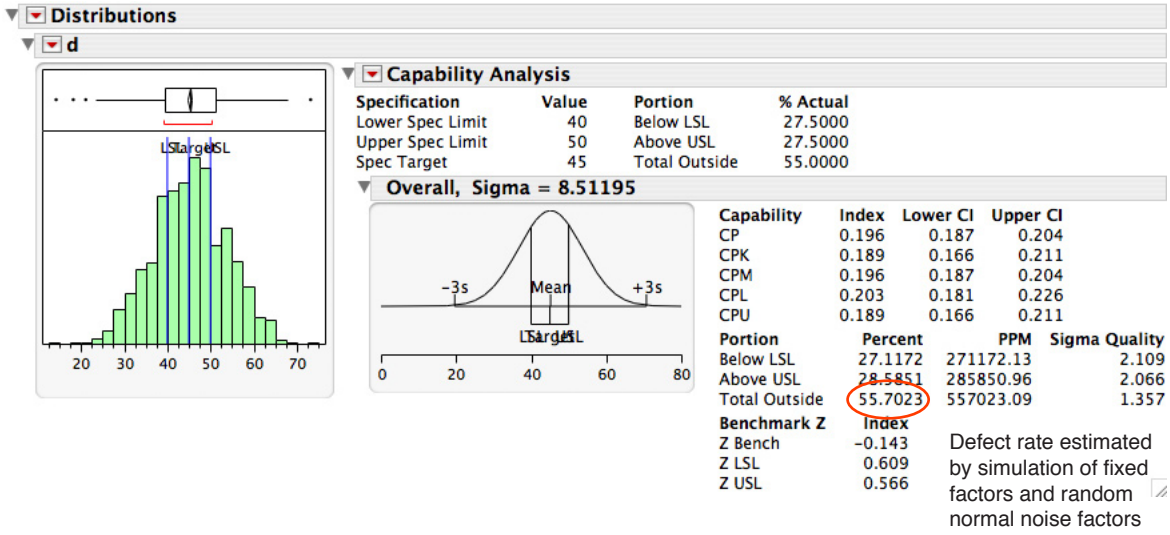


Figure 4 Distribution Analysis Shows 55.7% Defect Rate



In this particular example, there is a huge number of ways to match the target for d. Using the Contour Profiler, you can pick one of these ways, but it might not be the most robust way. That is, just matching the target for d does not guarantee that the resulting process is robust to variation in n1 and n2.

A better approach is to match a target in the flattest part of the noise response surface so that the noise has little effect on the process.

> The definition of flat is to have near-zero first derivatives.

JMP can find these flat points using the model prediction formula and the derivatives of the prediction formula with respect to each of the noise factors. To find these derivatives, save the prediction formula three times, into columns that JMP names Pred Formula d, Pred Formula d 2, and Pred Formula d 3. For clarity, rename the second prediction column deriv n1 and the third column deriv n2.

Now, use the second and third formula columns to find the derivatives for n1 and n2. *Figure 5* shows how to do this. Open the formula for deriv n1. Select any n1 term in the expression and choose the **Derivative** command from the menu above the keypad. The result is the derivative of the expression with respect to n1, the selected variable. Do the same thing in the deriv n2 formula column to get its derivative.

Set the Spec Limits column property for both derivative columns to get a capability analysis. To tell JMP that a zero value of the derivative is desired, set the Response Limits column property for the deriv n1 and deriv n2 columns, as shown in *Figure 6*.

Figure 5 Generate Derivatives Using the Column Formula Editor

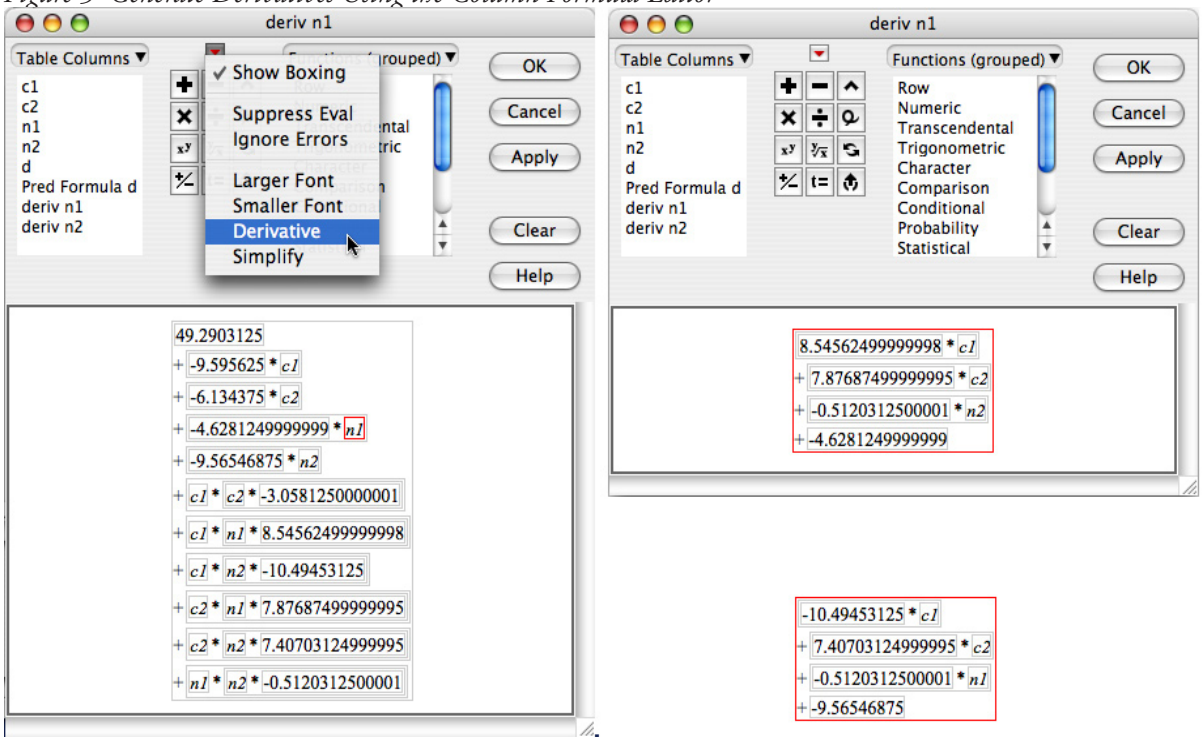
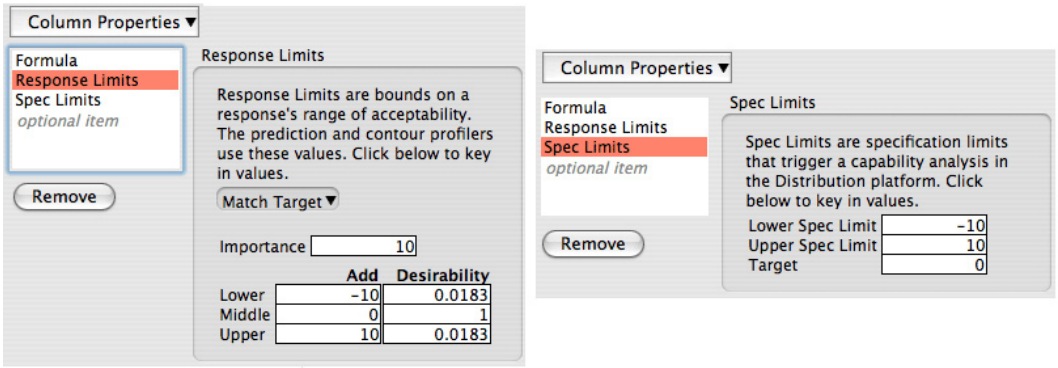


Figure 6 Response Limits and Spec Limits for deriv n1 *and* deriv n2 *Columns*



Now use **Graph** > **Profiler** and select the prediction formula column and both derivative columns as the Prediction Formula. Click **OK** and then select **Maximize Desirability** from the Profiler menu. *Figure 7* shows the Profiler results. The solution achieves targets for both the prediction expression and for the two derivative expressions. Notice that by making the derivatives close to zero, the current value for the upper right two graphs is hitting the response curve where it is very flat, *i.e.* where it is most robust with respect to variation in the noise factors. Run the simulator again, as before, with the factor settings found by the maximum desirability, and look at the distribution of the simulated prediction formula for d. The distribution of this simulation (see *Figure 8*) shows that you are now nearly defect-free. The defect rate is 0.0004%, compared with 55.7 % seen initially.

This rate is approximately 3.68 parts per million, very close to a Six Sigma quality level!

Figure 7 Profiler with Maximum Desirability for Predicted Response and Noise Derivatives

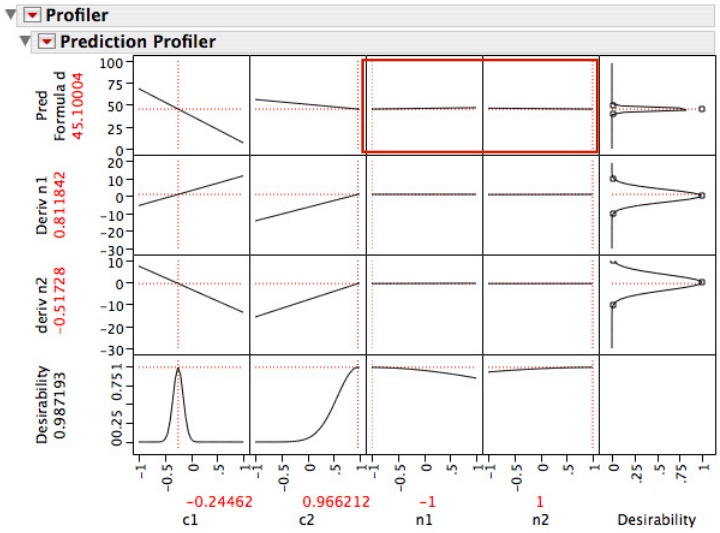
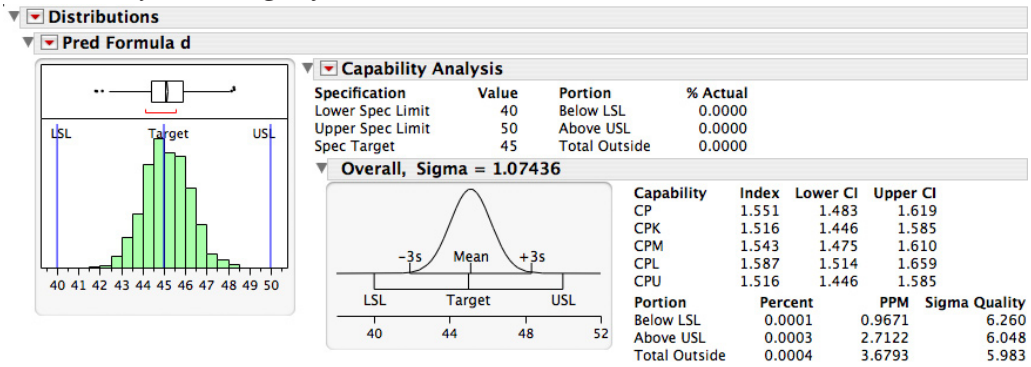


Figure 8 Distribution Analysis Showing Defect Rate Near Zero



This example works well because we set up the problem to have a large control-factor by noise-factor interaction. In a real-world situation, results might not be as dramatic. However, this example demonstrates a technique that might be applicable to a need for robust process engineering.

Review the steps needed to apply this technique :

1 Verify that you have an experiment and model with noise factors and interactions between noise and control factors.

2. After you fit the model, save the prediction formula for the response factor and again for each of the noise factors.
3. Use the formula editor to find derivatives with respect to each noise factor. That is, highlight a noise factor in the prediction formula and use the **Derivative** command in the formula editor.
4. Set Spec Limits and Response Limits column properties for the noise columns. Set zero as the Response Limits for the derivatives.
5. Invoke the Profiler and optimize to targets.
6. Simulate to see if these optimized settings produce the desired response distribution.

Interactive Tabulate For Nominal Variables

By Ann Lehman, SAS Institute

The **Tabulate** command in the **Tables** menu enables you to build tables of counts and statistics interactively. It is a drag-and-drop arena of rows and columns. This article uses the MushroomDemo.jmp table from the sample data library.

When you drop a nominal variable into the drop zone for a tabulate row or column, the values of that variable are listed and the number (N) for each value is shown in the cells of the tabulate table. *Figure 1* below shows the initial Tabulate platform, and the result when you drag the Edibility variable to the drop zone for columns.

Once you start a table, there are still many drop zones, but you must select a variable and mouse around the table to find them. The easiest way to learn is to try dropping a variable in a zone and see what happens. *Figure 2* shows the result when you drop the Gills variable above Edibility, below it, and to the upper left drop zone of the Tabulate table.

Figure 2 Drop Zones for a Simple Tabulate Table

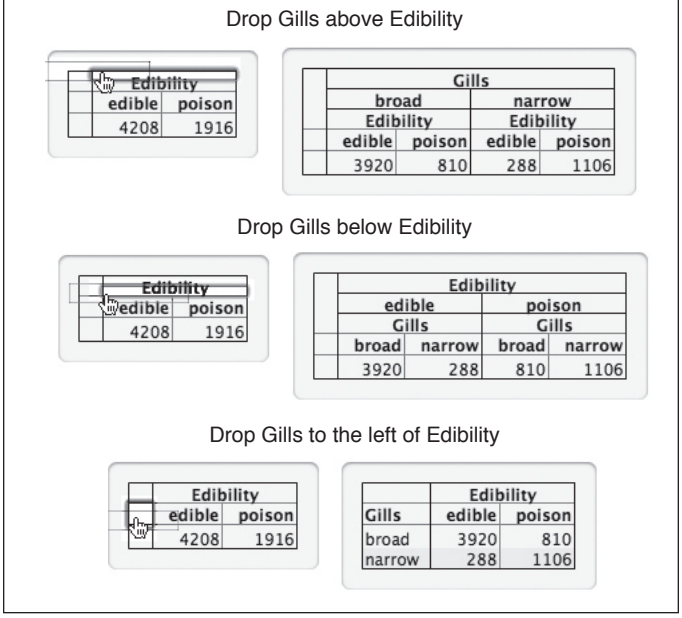
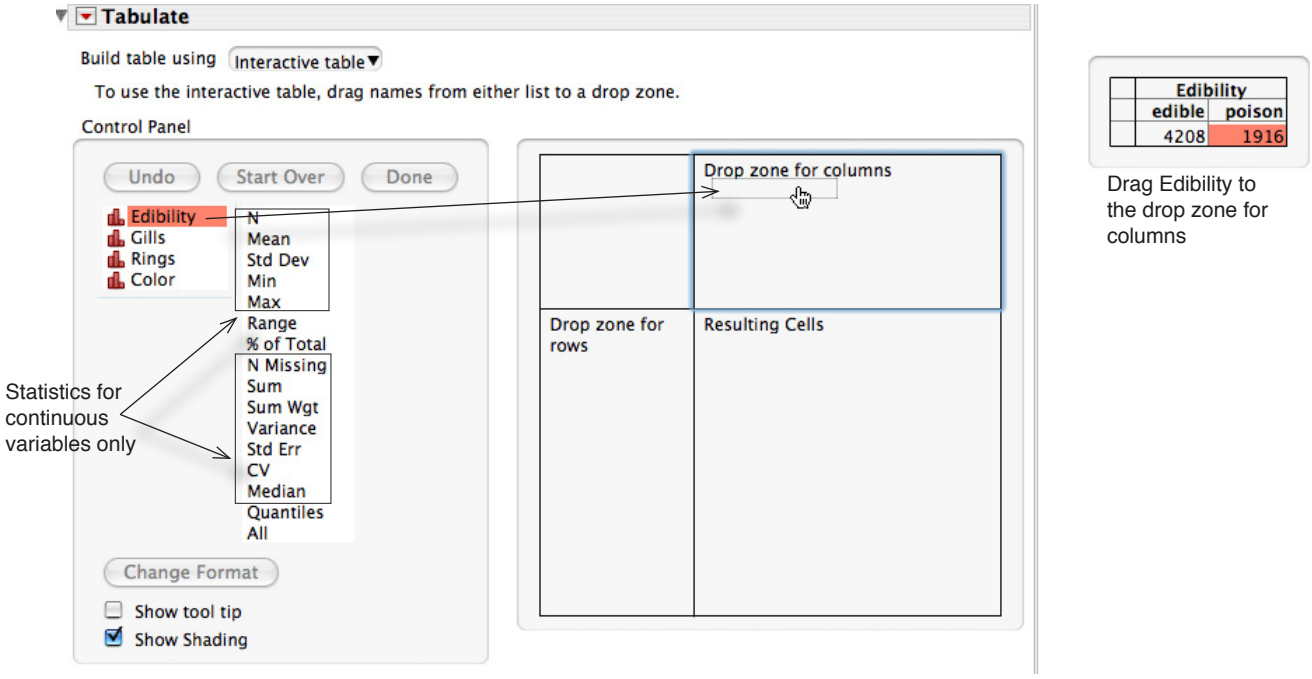


Figure 1 Begin Interactive Tabulate



In this simple example, you might see additional drop zones that have redundant effects when you drop a variable on them. These zones come in to play when there are more than two variables in the Tabulate table.

All of the variables in the data table are listed on the left of the Tabulate Control Panel. The summary statistics are listed next. For nominal variables, Tabulate counts the number of levels for each variable you enter into the Tabulate table, so only the N, % of Total, N Missing are meaningful. The All statistic can be used when there is both a column and a row variable.

Finding Total Counts and Percents

This example builds a simple Tabulate table of counts, row, column and grand totals, percent of grand total, and shows how to include row and column percents as well.

Begin a Table: Using the MushroomDemo data table, drag Edibility to the top of the table and Color to the left side, creating the table shown here.

	Edibility	
Color	edible	poison
brown	3440	224
chocolate	48	763
green	0	35
orange	48	0
purple	48	0
white	576	894
yellow	48	0

Column Totals: Next, select the All statistic and drag it to the Color drop area to create column totals.

Row Totals: Select the All statistic again, but drag it to the Edibility drop zone to create row totals.

column totals

	Edibility	
Color	edible	poison
brown	3440	224
chocolate	48	763
green	0	35
orange	48	0
purple	48	0
white	576	894
yellow	48	0
All	4208	1916

row totals

	Edibility		
Color	edible	poison	All
brown	3440	224	3664
chocolate	48	763	811
green	0	35	35
orange	48	0	48
purple	48	0	48
white	576	894	1470
yellow	48	0	48
All	4208	1916	6124

Percent of Total: Drag the % of Total statistic to the lower Edibility drop zone to replace the counts with percents.

Note: To remove any statistic from a Tabulate table, rignt-click on its name in the table and choose **Delete**.

Finding Row and Column Percents

Column Percent: There is no direct command to create column or row percents. Instead, first think about how a column percent is computed for a cell. For example, the ratio of brown edible mushrooms to total edible mushrooms of all colors is:

3440 ÷ 4208 = 0.8175 or 81.75%.

Since the denominator in this computation is the total edible mushrooms of all colors, dragging Color from within the Tabulate table (see *Figure 3*) to the % of Total drop zone recomputes each percent in that column using that column total (4208) as the denominator. Note that the column label changes to indicate which total was used to compute the percents (% of Total <Color>). Use **Undo** to remove the column percent.

Note: You can click **Undo** in the Tabulate Control panel at any time to see the table in its previous state.

Row Percent: The same logic applies to row percents. For example, the ratio of brown edible mushrooms to total brown mushrooms is:

3440 ÷ 3664 = 0.9389 or 93.89%.

Since the denominator in this computation is the total number of brown mushrooms, dragging Edibility from within the Tabulate table (see *Figure 3*) to the % of Total drop zone recomputes each percent in that row using the total of that row (3664) as the denominator. The new column label tells you which total was used as the denominator for the calculation (% of Total <Edibility>).

Figure 3 Include Total Counts and Percents

Drag % of Total statistic to the lower Edibility drop zone.

	Edibility		
	edible	poison	All
Color	% of Total	% of Total	% of Total
brown	56.17	3.66	59.83
chocolate	0.78	12.46	13.24
green	0.00	0.57	0.57
orange	0.78	0.00	0.78
purple	0.78	0.00	0.78
white	9.41	14.60	24.00
yellow	0.78	0.00	0.78
All	68.71	31.29	100.00

Double-click column labels to edit them

	Edibility		
	edible	poison	All
Color	% Color	% Color	% Color
brown	81.75	11.69	59.83
chocolate	1.14	39.82	13.24
green	0.00	1.83	0.57
orange	1.14	0.00	0.78
purple	1.14	0.00	0.78
white	13.69	46.66	24.00
yellow	1.14	0.00	0.78
All	100.00	100.00	100.00

To see column percent, drag Color to % of Total.

	Edibility		
	edible	poison	All
Color	% of Total <Color>	% of Total <Color>	% of Total <Color>
brown	81.75	11.69	59.83
chocolate	1.14	39.82	13.24
green	0.00	1.83	0.57
orange	1.14	0.00	0.78
purple	1.14	0.00	0.78
white	13.69	46.66	24.00
yellow	1.14	0.00	0.78
All	100.00	100.00	100.00

	Edibility		
	edible	poison	All
Color	% Edibility	% Edibility	% Edibility
brown	93.89	6.11	100.00
chocolate	5.92	94.08	100.00
green	0.00	100.00	100.00
orange	100.00	0.00	100.00
purple	100.00	0.00	100.00
white	39.18	60.82	100.00
yellow	100.00	0.00	100.00
All	68.71	31.29	100.00

To see row percent, drag Edibility to % of Total.

	Edibility		
	edible	poison	All
Color	% of Total <Edibility>	% of Total <Edibility>	% of Total <Edibility>
brown	93.89	6.11	100.00
chocolate	5.92	94.08	100.00
green	0.00	100.00	100.00
orange	100.00	0.00	100.00
purple	100.00	0.00	100.00
white	39.18	60.82	100.00
yellow	100.00	0.00	100.00
All	68.71	31.29	100.00

"JMP" Into Stats at the University of Tennessee at Knoxville

by Ramón V. León and Frank M. Guess, Department of Statistics, Operations, and Management Science and Timothy M. Young, Tennessee Forest Products Center, University of Tennessee at Knoxville

JMP is used extensively at the University of Tennessee (UT) in undergraduate introductory statistics courses, advanced graduate statistics courses, MBA courses, executive education courses, summer internships, and forest product work. This article describes these varied applications of JMP and provides links to public domain JMP tutorials and teaching notes used at UT.

Using JMP in Undergraduate Introductory Classes

At UT, undergraduate students learn JMP in introductory classes such as statistics for business, regression, and experimental design. In fact, from fall 2004 to summer 2005, over 1,780 students at UT learned JMP and statistics in Statistics 201, an introductory Statistics for Business class that carries a calculus prerequisite and has been taught by American Statistical Association Fellow Dr. Bobby Mee. A prepared web site of course tutorials, developed by Dr. Ramón León, is available at

http://web.utk.edu/~leon/201Tutorials/

The tutorials cover everything from importing Excel files to creating box plots that represent earnings of hourly workers at a national bank.

Non-business majors also learn JMP through a general undergraduate statistics class. While other software packages, such as SAS®, S+, R, MATLAB®, and SPSS®, are also utilized at UT, JMP is learned, used, and understood by the largest numbers of students because it is the complementary software for the introductory statistics course they are required to take. The majors of these students range from business to engineering to arts and sciences.

Additionally, JMP is used in UT's prestigious, five-year Alan H. Lasater Dual B.S./M.S. Program in Statistics.

The widespread use of JMP at UT is due to both the quickness and success with which new users can learn JMP's advanced tools. These tools allow students to grow in statistical thinking and sophistication. For example, in the regression course, professors use JMP to teach students how to easily explore for outliers and leverage points, model verifications, and more.

UT also makes it easy for all students, faculty, and staff to access JMP. They can download a free copy based on an established technology fee and license agreement. Also, Dr. Mee, Dr. León, and others are JMP beta testers, providing the software developers with feedback and requests based on their needs.

Using JMP in Graduate Classes

UT's MBA courses use JMP as their statistical package. Mee uses JMP in his graduate-level design of experiments and MBA courses. JMP is also useful in short courses taught by UT's Center for Executive Education that leads to certification for Six Sigma Black Belts.

Dr. Ramón León teaches his introductory graduate statistical methods course, Stat 571, whose objectives include understanding main statistical concepts, using JMP to extract information from most common forms of data, understanding probability and sampling distributions, Chi-Square test for categorical data and nonparametric methods, and preparing to take follow-up courses in statistics. Dr. León's JMP tutorials for the course are available at

http://web.utk.edu/~leon/stat571/jmp/

His notes for this course are integrated with JMP and are found at

http://web.utk.edu/~leon/stat571/Handouts.html

His tutorials for other statistics courses are available at

http://web.utk.edu/~leon/jmp/

Many people outside UT, in industry and academia, use his tutorials in their own courses and for self learning.

Using JMP in Research

Research Associate Professor Tim Young of UT's Forest Product Center uses JMP and JMP scripting to automate statistical reports and control charts in his work with forest product companies in North America. He has taught more than 70 companies about process improvements in forest products. These companies vary from furniture manufacturing to salvaging waste wood to producing modern engineered wood products with high strength and reliability. The U.S. forest products industry contributed $406 billion to the economy and employed 2,140,399 people in 2002, according to the U.S. Census Bureau 2004.

Dr. Young and Dr. Frank M. Guess presented their work as keynote speakers at the JMP User Conference on June 8-9, 2005, in Cary, NC. Some of their other work was presented using JMP at a 2003 MIT conference by their former graduate research assistant (GRA), David Edward. Another current GRA, Weiwei Chen, presented a poster session at the JMP 2005 User Conference. They choose to use JMP during their presentation because they wanted to showcase JMP's graphical and exploratory features.

UT Teams with SAS Institute JMP Trainers

Mark Bailey, a JMP trainer from SAS Institute, gave a JMP scripting workshop at UT on February 4-5, 2005. Approximately 50 current students and alumni along with seven faculty members attended this two-day workshop.

Attendees' backgrounds included electrical engineering, industrial engineering, material science and engineering, statistics, management science, finance, animal science, forestry, and forest products engineering. This reflects the incredibly strong pull JMP has across many disciplines at UT.

One of the class attendees, an alumnus with a local $300 million-per-year company, used JMP scripting tools immediately after the class to automate statistical analyses in key work projects.

Furthermore, UT students on summer internships, especially those with design of experiments or regression projects, have found JMP incredibly useful. The ability of JMP to double check for key assumptions and model verification are features they value. Because of the success of this class, UT has scheduled several upcoming workshops for its students, alumni, and faculty.

Conclusion

JMP is used extensively at the University of Tennessee (UT) in undergraduate introductory statistics courses, advanced graduate statistics courses, MBA courses, executive education courses, summer internships, and forest product work. We hope that our account of how we use JMP helps you think creatively about how you can use JMP in your university classrooms and research labs. We also hope that the links to JMP tutorials and teaching notes used at UT will give you ideas for incorporating JMP into your lesson plans.

Dr. Mary Sue Younger chats during a break with Students and Mark Bailey from SAS

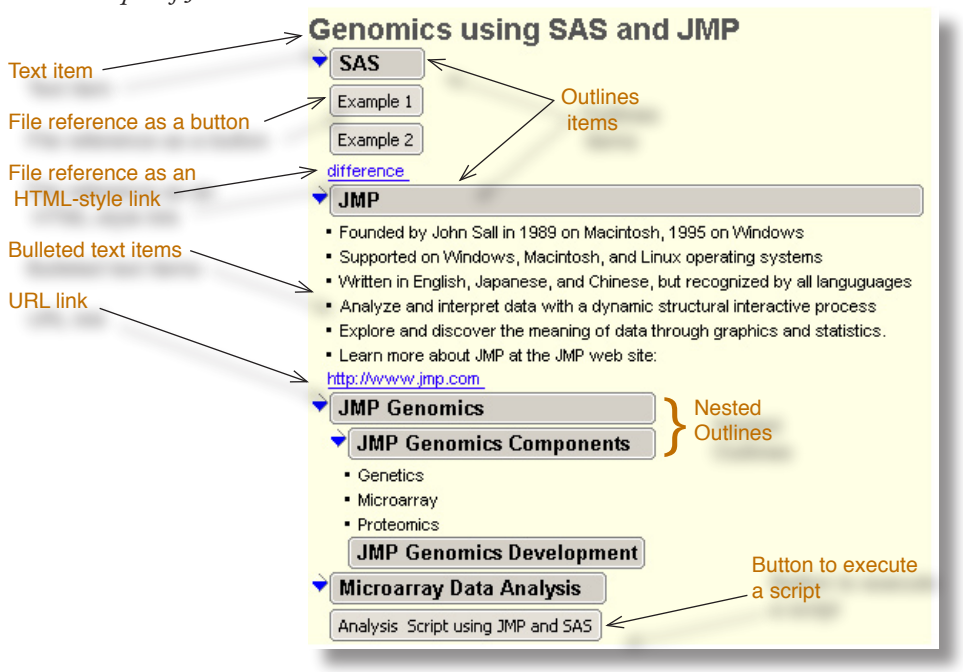
Creating a JMP Journal Presentation

By Wenjun Bao, SAS Institute

The JMP journal is a way to record a data analysis process and its results. The journal also offers a unique tool to prepare a presentation. The fall 2005 issue of JMPer Cable (Issue 18) gave an example of using the JMP Journal to prepare a presentation. This article elaborates on the Journal presentation capabilities.

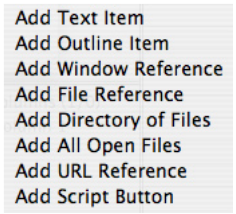
The Journal can capture almost any JMP file, as well as graphs, launch dialogs, reports, and scripts. You can also embed links to data tables, JSL files, HTML files, web pages, and directories. These links are especially useful when a presenter wants to demonstrate the dynamic relationship among JMP tables and graphics results. *Figure 1* identifies many of the items you can have in a Journal presentation.

Figure 1 Example of Journal Presentation Items



Building a JMP Journal Presentation

To build a journal presentation, first create a new folder to hold the journal and its referenced files. Then, start a new journal using **File** > **New** > **Journal**, or click **New Journal** on the JMP Starter. Right-click anywhere in the journal window and select from the resulting menu, shown to the left.



To add an item to the end of an existing outline item in a previously saved journal, right-click on the outline and choose from **Append Item**, as shown in *Figure 2*.

Use the following options to build a journal presentation.

Add Text Item

Enter text and select either paragraph or bulleted style. To format text, right-click on the text and select a formatting command.

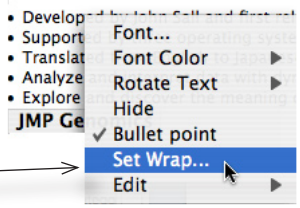
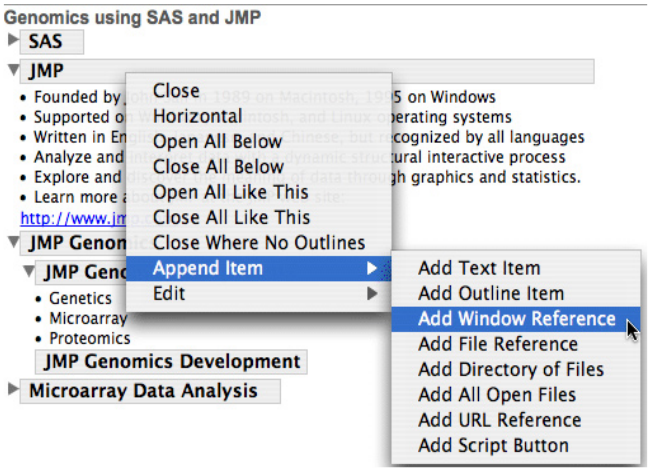


Figure 2 Journal Presentation Commands



Add Outline Item

An outline item is a useful container for grouping items. You can follow an outline item with any other item in the journal menu. When an outline has sub-items, the diamond-shaped reveal button appears next to it so that you can expand or close sections of the presentation as needed.

Add Window Reference

Select from the list of open windows to add a link to that particular window. Clicking on the link in the journal brings that window to the front.

Add File Reference

To add a link to a file, select **Add File Reference**. A file reference in the journal opens the file in JMP with a single click. Some types of file references that you could use in a JMP journal presentation are listed here.

File Type	File Extension
Table files—JMP, SAS, Excel, and Text	.jmp; .sas7bdat; .xls; .cvs; .txt
JMP journal and report	.jrn; .jrp
JMP script	.jsl
MS access	.mdb
html files	.html; .htm

To verify that a link opens correctly, right-click on it and select **Set Script** to view or change the file path. If you open a script file (.jsl), the script opens in the script editor.

Add Directory of Files

This command lets you navigate to a folder and adds links to all its members at once in the journal.

Add All Open Files

This command adds an outline item for each open JMP data table. Each outline item includes links to that table and all of its open analysis reports.

> Note: This command is resursive, so files in all the folders within folders are also added to the outline item.

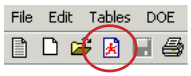
Add URL Reference

Clicking on a URL reference in the journal presentation opens in your default browser, and also allows you to link any files (PowerPoint .ppt files, Word .doc files and Excel .xls files) that can be saved as html or hml files. These files are also opened in the browser.

Add Script Button

The journal accepts scripts either as file references (**Add File Reference**) or embedded as buttons in the journal. This command opens a script window where you can enter JSL commands and name the script. When you click the script button in the presentation, the script automatically runs.

If you need to manually execute an open script, select **Edit** > **Run Script** or use the Run Script button (little man) on the tool bar.



By default, links are underlined, as shown previously in *Figure 1*. To change underline links to button appearance, right-click on the link and uncheck **Underline Style**.

You can add, change, rearrange, or delete any of the journal items at any time.

- To add an item, select it from the menu items shown in *Figure 2* and follow the instructions. To add graphics, use copy and paste to place them directly into the journal.
- To delete an item, select the large plus selection tool from the tools menu or toolbar, click on the item to be deleted, and press the Delete key.
-  To rearrange the order of items, use the large plus selection tool to select and drag the item up or down to a new position. You can also drag an item next to another (drag left or right). When you drag with the selection tool, drop areas appear as you move around the journal surface.
- To delete an item with sub-items you don't want to delete, use the large plus selection tool to move the lower level items to the side of the ones you want to delete. Then, delete the items you don't want.

Add PowerPoint® Slides to the Presentation

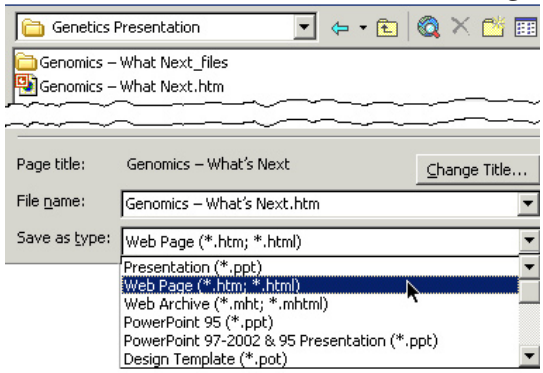
Presenters often use PowerPoint or Keynote® slides to summarize material. You can access these slides from a JMP journal presentation using a file reference. There are several steps in the process to do this:

1. Create a folder to hold both the JMP journal presentation and the PowerPoint presentation.
2. Prepare the JMP journal presentation as described in this article.
3. Open the PowerPoint presentation and save it in web format (.htm or .html) in the same folder.
4. In the journal presentation, add a file reference to the HTML version of the slides.
5. Use **Set Script** to generalize the file reference path.

Here is an example. Assume you have a JMP journal presentation like the one shown in *Figure 1*, and a set of PowerPoint slides that discuss the JMP Genomics components you want to show in the journal:

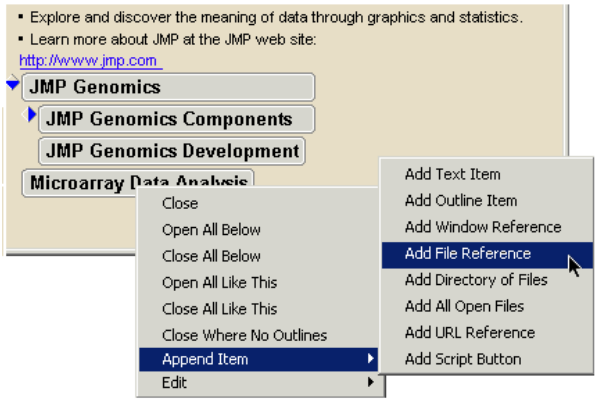
- Open the PowerPoint presentation and use **File** > **Save As** to save it in the same folder as the JMP journal presentation. On the save dialog, choose Web Page (*.htm; *html) from the Save as Type options, as shown in *Figure 3.*

Figure 3 Save JMP and PowerPoint Presentations Together



- In the JMP journal, right-click the outline item where you want to add the PowerPoint presentation and select **Append Item** > **Add File Reference** (*Figure 4*).

Figure 4 Add File Reference to PowerPoint Presentation



- Choose HTML Files in the Files of type list and select the master PowerPoint slide, as shown in *Figure 5*.
- Finally, generalize the presentation so that you can use it on any machine. Right-click the reference to the PowerPoint presentation and select **Set Script**. This opens a script window with a script that includes the path, as shown in *Figure 6*. Change the reference path to include only the file name within quotes. This generalized link works on any computer, as long as both the journal and the slides that were saved as a web page are in the same folder.

Figure 5 Select the Master PowerPoint Slide

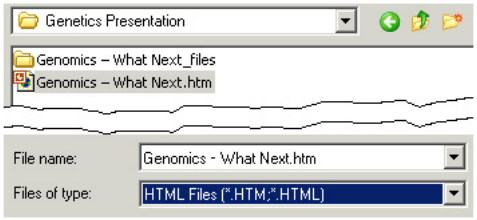
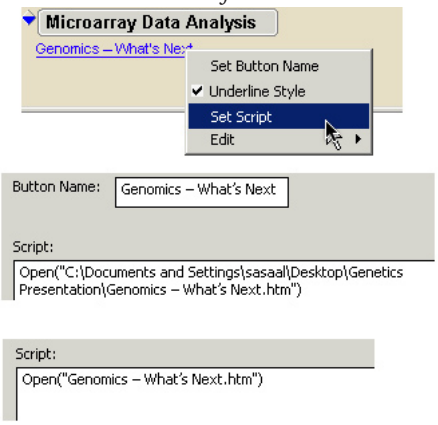


Figure 6 Generalize the File Reference Path



This article demonstrated that a JMP journal offers a unique way of presenting a variety of file types, including data tables, graphics, websites and any files that can be saved as html or htm files such as those from PowerPoint, Word, Keynote, and Excel files.

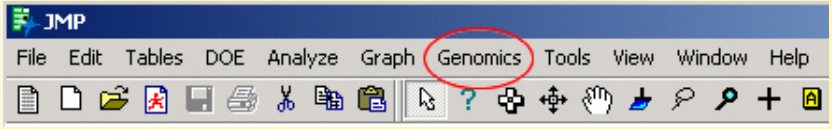
What is JMP Genomics?

JMP Genomics is a powerful desktop software system for statistical analysis of genetic marker, microarray, and spectral (proteomics and metabalomics) data. JMP Genomics uses JMP as a powerful and dynamic data visualization and statistical analysis desktop client to SAS. New genomics dialogs employ the JMP Scripting Language (JSL) to directly launch SAS macro programs in the background. This enables access to full power of both SAS and JMP data processing capabilities.

Three separate products in the software system cover the three main types of high-throughput data arising from the central dogma of molecular biology: DNA→RNA→Proteins.

- JMP Genetics—for genetic marker (SNP) data, case-control or pedigree experiments
- JMP Microarray—for gene expression or RNA transcript abundance data
- JMP Proteomics—for spectral (mass spec or NMR) data on peptides or metabolites

Each product includes the necessary SAS products plus a fully functional version of JMP 6 with added genomics capabilities accessed through a JMP Genomics menu.



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