stateaser

Workshop Schedule

Experiment Design Made Easy

February 9-10, 2010: Minneapolis, MN
March 25-26, 2010: King of Prussia, PA
April 27-28, 2010: Minneapolis, MN

Study the practical aspects of design of experiments (DOE). Learn about simple, but powerful, two-level factorial designs. $1295 ($1095 each, 3 or more)

Response Surface Methods for Process Optimization

April 29-30, 2010: Minneapolis, MN

Maximize profitability by discovering optimal process settings via RSM. $1295 ($1095 each, 3 or more)

Mixture Design for Optimal Formulations

January 26-27, 2010: Minneapolis, MN
May 18-19, 2010: Minneapolis, MN

Find the ideal recipes for your mixtures with high-powered statistical tools. $1295 ($1095 each, 3 or more)

Designed Experiments for Life Sciences

February 23-24, 2010: Minneapolis, MN
May 24-25, 2010: San Francisco, CA

Learn how to apply DOE to Life Science problems. $1495 ($1195 each, 3 or more)

European DOE User Conference

Late Spring 2010: Stay tuned for more info!

Get the latest alerts via Mark Anderson's DOE FAQ Alert. Sign up at www.statease.com/doealertreg.html.

PreDOE: Basic Statistics for Experimenters (Web-Based)

PreDOE is an entry-level course for anyone who needs to go back to the basics of statistics. See www.statease.com/clas_pre.html for more information. FREE (a $95 value)

Attendance is limited to 16. Contact Elicia at 612.746.2038 or workshops@statease.com.

Design-Expert®, Version 8 Software Released!

Stat-Ease is proud to announce the release of Design-Expert, version 8 design of experiments (DOE) software. This major upgrade offers powerful new statistical tools & unique features for ease-of-use, functionality, and power. If you are using an earlier version of the software, you'll want to upgrade (see page 4) to get all of the latest and greatest tools. What is so good about Design-Expert, version 8? Read on for a sampling of the many wonderful things you'll find in this new release.

Design-Expert software offers two-level factorial screening designs, general factorial designs, response surface method (RSM) techniques, mixture design techniques, and the ability to do combined designs with process factors, mixtures components and categorical factors. In version 8 you'll find new graphics and an improved interface, better mixture design and modeling tools, more choices for custom-designing your experiment, additional statistics and more concise reporting of results, increased visibility and versatility of tools and features, enhanced design evaluation, and an easier and faster program.

New graphics and improved interface

○Half-normal selection of important effects on all factorial designs: *This is a simple and robust method for selecting important effects—formerly available only for two-level designs. For example, the screen shot in Fig. 1 (page 2) is from an experiment on 5 woods glued with 5 adhesives, using 2 applicators with 4 clamps at 2 pressures. The vital effects become apparent at a glance!*

○Smoother color gradations on 2D contours (see Fig. 2 on page 2): *Make*

"Congratulations! I want to compliment you on Design-Expert 8. This software is absolutely wonderful. In fact, it is so good that I don't want to go back to Design-Expert 7 even though I have that software on my computer, too. If you ask what the difference is, my answer is that it is easy to use with everything at one's fingertips...This software for DOE is a dream..."

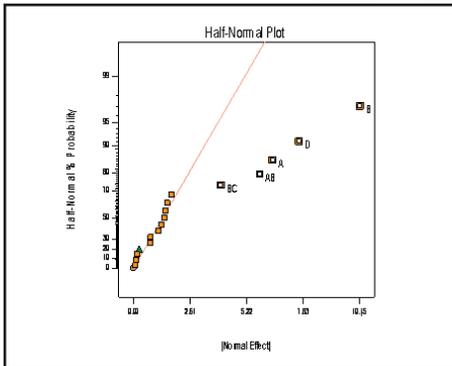—Harlan Faller, Sr. Technologist, Johnstech International
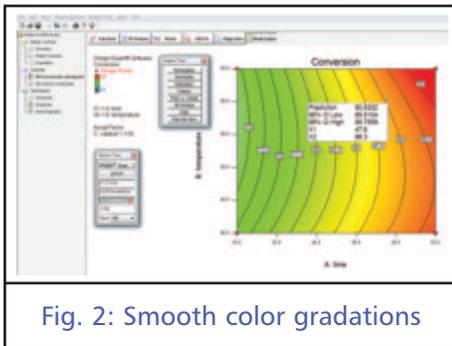
Fig. 1: Half-normal plot of effects

Fig. 2: Smooth color gradations

more impressive presentations to management, clients, or colleagues.

❍Plant flags on 3D surfaces (see Fig. 3 below): *Previously, you could only plant flags on 2D contour plots.*
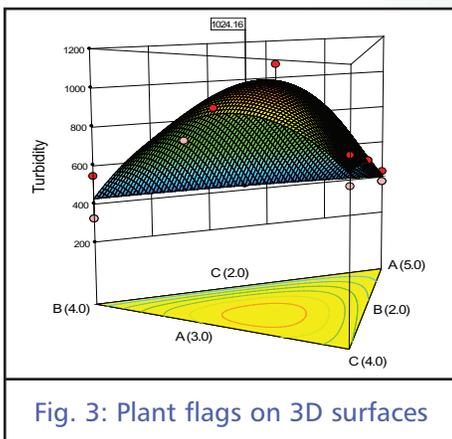

Fig. 3: Plant flags on 3D surfaces

❍New, fully configurable mesh option that reflects smooth, lighted colors off your 3D surface: *Dazzle your customers and colleagues while providing highly informative graphics showing how responses will react to process changes. (Mesh can be turned off if you like.)*

Better mixture design and modeling tools

❍Partial quadratic mixture (PQM) analysis (see Fig. 4 below): *Model nonlinear blending behavior most effectively.*
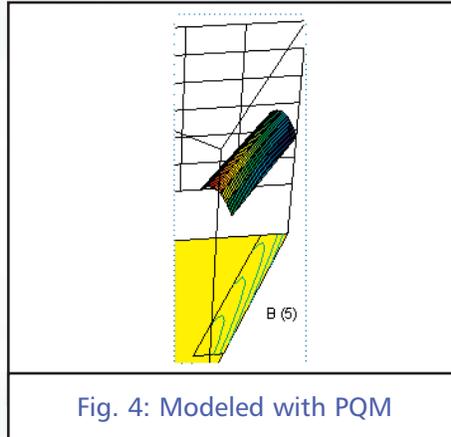

Fig. 4: Modeled with PQM

❍Design for linear plus squared terms in mixture models: *Reduce the number of blends required for optimally designed experiments that reveal non-linear blending.*

More choices when custom-designing your experiment

❍D-, IV-, and A-optimal design selection: *New and expanded criteria when crafting experiments to models of choice within realistic constraints.*

❍Constraints calculator: *Simplifies derivation of constraint inequalities. Exclude part of the design space using a multilinear constraint equation generated from a few user inputs. An optimal design is then fitted to the region.*

❍Tolerance-interval-based design sizing (see Fig. 5): *Enhances your fraction of design space (FDS) plots to assess whether your planned experiment is large enough, given the underlying variability (noise), to establish tolerances within the acceptable range.*

Enhanced design evaluation

❍Several new matrix measures are now provided: *Most notable is the G-efficiency. (This criterion, expressed on a 0 to 100 percent scale with higher being better, leads to designs that generate more consis-*
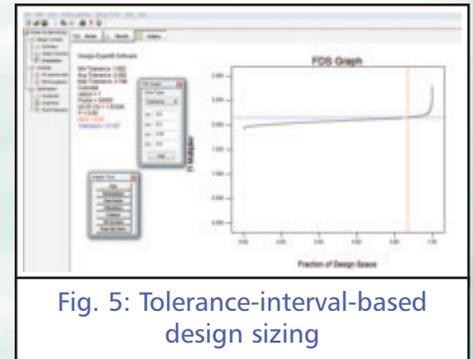

Fig. 5: Tolerance-interval-based design sizing

tent variance of your predicted response. However, like any other single measure, it may not accurately reflect the overall effectiveness of a particular matrix. That's why Design-Expert provides an array of matrix statistics and graphics for overall design evaluation.)

❍Fraction of paired design space (FPDS): *This resourceful tool lets you assess the power of RSM or mixture designs to detect specified signals (response differences judged important) in the presence of noise (system-standard deviation).*

Many things made nicer, easier, faster throughout the program

❍One-click updates: *Check for free software releases with one click and download them directly.*

❍Zoom up graphs with your mouse wheel (a right-click resets to original size): *Quickly zero in on regions of interest.*

❍Many new, high-visibility tools: Options previously available via hidden View menu options are now easily seen.

There are so many new features in Design-Expert 8 that only a fraction of them could be mentioned here. See *http://www.statease.com/dx8descr.html* for the full list of features. You'll also find a link there to the free 45-day trial. Test drive DX8, and then order your copy without delay so that you can benefit from this powerful and user-friendly DOE package (see page 4 for an order form). If you have any questions, please contact us at 612.378.9449 or info@statease.com.

FAQ on Graphical Selection of Factorial Effects

Design-Expert 7 User Question:

"My effects pretty well form a straight line in the half-normal plot, and my first instinct is to declare no significant effect. However, when I look at the Pareto Chart, I note that main effect B peeks up above the t-test line, before I do any selection. If I select this effect, I get a p-value in the ANOVA of 0.02, weak but still significant at 0.05. Despite the appearance of the half-normal plot, should main effect B be at least considered "possibly significant"?

Pat's Answer:

Great question! One reason it's great is because now I get to discuss why I strongly favor graphical selection of effects for factorial designs.

The largest effect always looks large, but is it really large enough to be considered statistically significant? This is the general problem.

In this two-level full factorial on four factors (2^4) we are testing 15 effects (4 main, 6 two-factor, 4 three-factor, 1 four-factor). The largest of these is plotted at 96.67% on the probability axis of the half normal plot. Conversely we could say the largest observed value from a sample of 15 from a normal distribution has an expected p-value of 3.3%. If a p-value of 3.3% is expected when the null hypothesis is true, then your observed p-value of 2% (0.02) is not very strong evidence to reject the null hypothesis. This is why I really like the graphical representation on the half-normal plot; if the largest point falls in line with all the other effects then there is little evidence of significance (see Fig. 1).

One could also look at the Pareto chart of the t-values of the effects (see Fig. 2). On the Pareto chart there are two refer-
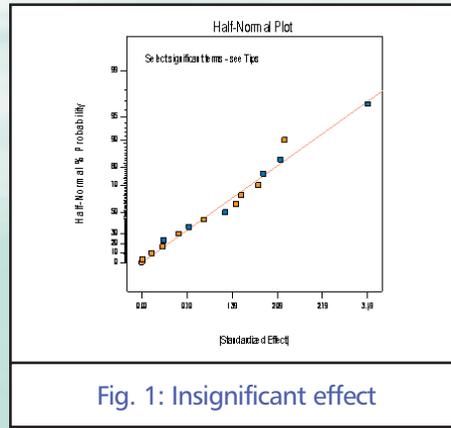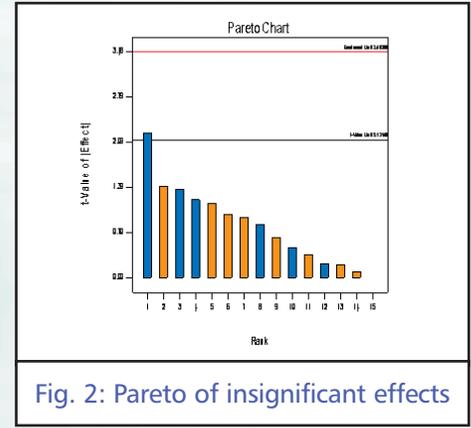

Fig. 1: Insignificant effect

Fig. 2: Pareto of insignificant effects

ence lines. The lower reference line (black) represents the t-value for controlling type I error (falsely rejecting the null hypothesis) at 5% for each individual effect. Since we are testing 15 individual effects and each one has an error rate of 5%, the overall chance of falsely rejecting the null hypothesis is much higher. Therefore to control the overall risk at no more than 5% we divide the 5% by the number of effects (in this case 5%/15) and add the upper reference line. (This is known as the Bonferroni correction*.) Any effects above the upper reference line (red) are significant and any below the lower reference line (black) are not significant. In between it can be hard to say. (In this example the B effect is much closer to the lower reference line than it is to the upper.) My advice is to select the obvious effects using the half normal plot (in this example there are no obvious effects) and then use the Pareto chart if there are "shoulder" effects.

New in Design-Expert 8 (DX8)

As designs become larger graphical representation becomes even more important to gauge statistical significance. With designs of 15 (or more) effects, selecting strictly based on a p-value of 5% in the ANOVA doesn't make good statistical sense. However,
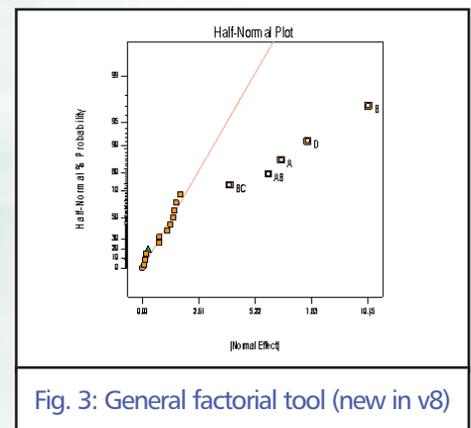

Fig. 3: General factorial tool (new in v8)

we are so enthusiastic about using half normal plots to select factorial effects that we have now extended its use to general factorials in Design-Expert, version 8! Figure 3 shows the use of the Half-Normal plot of effects on a 5x5x2x4x2 fractional factorial design, eliminating the need to study a table of mean squares and p-values. Download a trial of DX8 at http://www.statease.com/dx8trial.html and check it out yourself!

—Pat Whitcomb, pat@statease.com

*Learn more on this subject in *DOE Simplified, 2nd Edition*, 2007, Anderson & Whitcomb, Chapter 3, Two-Level Factorial Design, Appendix: How to Make a More Useful Pareto Chart.

Order New Design-Expert 8 Software Today!

Improve your product or process with Design-Expert (DX), Version 8 software. Don't wait! Take advantage now of special discount upgrade pricing through March 31st, 2010.   For product details on DX8 and more, visit the Stat-Ease web site at *http://www.statease.com*. Download a free 45-day trial at *http://www.statease.com/dx8trial.html*.

To place your order, call 612.378.9449, fax this form to 612.746.2069, or mail it to the address below. Thank you for your business!

Qty	Item	Other Required Information	Unit Cost	Ext. Cost
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	Upgrade to DX8 from DX7.0, Old Serial # required:		$295 (reg. $395)	
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	Upgrade to DX8 from any version of Design-Ease, Old Serial # required:		$595	
	Design-Expert 8 Annual Network [**3-seat** annual license (includes free upgrades and updates)]		$1050/year	
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