



## One if by Hand Two if by 'Ease

These famous words of Paul Revere come to mind as Stat-Ease prepares to display its softwares at the Annual Quality Congress (AQC) in Boston on May 24 - 26. Visitors to the '93 AQC will be treated to a sneak preview of the graphical user interface (GUI) version of **DESIGN-EASE** software, due for release later this year. The Stat-Ease programming team led by Tryg Helseth, with Jim Mork on Windows and Erik Jordan on the Mac, are working very closely to ensure consistency between the competing GUI operating systems.

When the time comes, registered **DESIGN-EASE** users will be given the chance to upgrade into one of the new GUI platforms at a reasonable cost (not announced yet). Stat-Ease plans to indefinitely continue sale of the current DOS version of **DESIGN-EASE**.

## Half Price Offered to Workshop Repeaters

Stat-Ease recently reconfigured the old advanced DOE course in to two separate 3.5 day workshops:

- Response Surface Methods for Process Optimization**
- Mixture Design for Optimal Formulations.**

These workshops contain a wealth of new material. If students of the old Advanced Experiment Design wish to attend one or both of these workshops, they may do so at half the normal tuition. (The same policy applies to repeaters of **Experiment Design Made Easy**.) Call us for details.

## "Experiment Design Made Easy" Schedule Expanded: Spring/Summer in Minneapolis, Fall in Philadelphia

The demand for Stat-Ease's introductory DOE workshop, **Experiment Design Made Easy**, continues to grow, with sell-outs at the two classes offered so far this year. Therefore, the public offerings will be expanded to accommodate demand.

The schedule will be as follows:

- May 11-14 (Minneapolis)
- July 27-30 (Minneapolis)
- September 14-17 (Philadelphia)

The **Experiment Design Made Easy** workshop provides in-depth coverage of two-level factorial design.

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**"Highly recommended!"**

Melinda Reyes, Ciba-Geigy

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Participants use **DESIGN-EASE** software to analyze various case studies and simulations.

The instructors, Pat Whitcomb and Mark Anderson, have been very

busy since the first of the year. In addition to the public sessions, they've presented **Experiment Design Made Easy** to groups at Behr Process (a producer of top-quality coatings), Cargill, Sara Lee, Owens-Corning and Dow. These clients took advantage of the private presentation, which allows free discussion of concerns unique to the firm, and creates a common ground upon which to build improved experimental programs. For groups of six or more, an in-house workshop is much more cost-effective than sending individuals away to a public presentation.

Details on scheduling an in-house session or an open presentation of **Experiment Design Made Easy**, or any other statistical workshops, can be obtained by calling **800/325-9816** (or 612/378-9449 direct). Ask for Bonnie.



Erik Jordan demonstrates a developmental version of **DESIGN-EASE** for the Mac to fellow programmers Jim Mork (left) and Tryg Helseth (right).

## Statistical Design of Experiments Made Easy as Popping Corn: Round Two

**DESIGN-EASE** software makes design of experiments (DOE) as easy as cooking microwave popcorn. In the last "Stat Teaser" newsletter I reported the following results from a two-level DOE in the family kitchen:

- Highest power works best
- Elevating the bag helps
- Expensive brands pop better
- Preheating the microwave chamber made no difference

The study also gave us the optimal cooking time. As a result of this experiment we reduced unpopped kernels by 80 percent, a major gain in yield. We also improved taste.

The purchase of a new microwave precipitated a second round of testing. This high-tech machine provides a special setting just for microwave popcorn! Bags produced according to the factory settings came out with very few unpopped kernels, but the question remained as to whether even better yields could be obtained. So we embarked on round two of the quest for perfect popcorn.

Based on the findings from the first study, we decided to keep power at its highest level, as recommended by the microwave maker. However, with the new (more powerful) machine, we would need to re-investigate the cooking time. Plus, a brainstorm with my children resulted in the identification of two new

factors to test: prechilling the popcorn in the freezer (yes or no), cooking on a carousel (yes or no).

With the help of **DESIGN-EASE**, we then produced a two-level full factorial design with all the combinations of highs and lows of the three factors, eight runs in all. (The time settings were chosen at levels just below and just above the level set by the microwave manufacturer.) To get an estimate of pure error, I added four replicates at the baseline settings. We then printed a list of all 12 runs in random order, with entry blanks for the two responses: weight of unpopped kernels, and taste rating.

Using the "recipe" sheet as a guide, my son produced the experimental popcorn. He set the popped corn out for the tasting panel (my daughter and I). Then he weighed the residual on a postal scale. Finally after a weekend of all out effort, he typed the results in to **DESIGN-EASE**. The statistical output indicated:

1. Prechilling reduced yield.
2. The carousel reduced yield.
3. The lower time reduced yield due to undercooking, and the higher time reduced taste due to overcooking. The preset time at the center of the factor range worked best after all!

Unlike the first experiment, which produced dramatic improvements, the

second study proved to be somewhat disappointing. However, it did accomplish the objective by proving that the manufacturer's settings were correct.

In future we might try bolder levels of time when cooking prechilled popcorn on the carousel. Evidently from the poor cooking we saw at this combination, more power input would be needed for optimal results. However, let the reader be warned, popcorn will char very rapidly if you overshoot on time by even a half a minute. We learned this the hard way, much to our surprise. My wife was only partially mollified by my son's admonition that "when doing experiments you learn from your mistakes".

The same approach outlined for popcorn can be applied to any production process, at home or at work. Two level factorial designs can easily be set up and analyzed with **DESIGN-EASE** software. These simple DOE's provide efficient means to quickly identify critical factors and significant interactions, which often lead to breakthrough improvements. Experimenters cannot afford to overlook this powerful tool, especially when it's as easy as popping corn.

*Mark J. Anderson*



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