The Stat Teaser

our 10th year
A Decade of DOE Excellence

Stat-Ease, Incorporated | *"Statistics Made Easy"*℠ | Summer 1995

FREE DOE Guides!

Where do you turn when you get hung up on a DOE question? Thick textbooks? Pages and pages of manuals? The statistics department? Relax. Getting unstuck is a lot easier now with our just-released DOE guides. Fax us your request for any of the helpful guides listed below. They're FREE! All you have to do is fax us at 612-378-2152.

Because of the expected demand, we need your help as follows: Mark your choices on the other side. (You'll find a Request Form there for your convenience.) Then fax the entire page to us. We'll mail your guides, so be sure to correct the address label, if needed.

Factorial Analysis Guide*

A succinct review of the key steps in factorial design. Important information about probability plots, ANOVA, t-values, and plots. Example graphs and plots are included. Four pages.

Response Surface Analysis Guide**

Overview includes aliased models, sequential sum of squares, lack of fit, and numerical optimization. Sample perturbation plots, contour plots, standard error and optimization plots included. Four pages.

Mixture Analysis Guide**

This is the guide you need to stay fresh on outlier t-values, adequate precision, trace plots, and contour plots, among others. Standard error and optimization 2-D and 3-D plots are reviewed. Four pages.

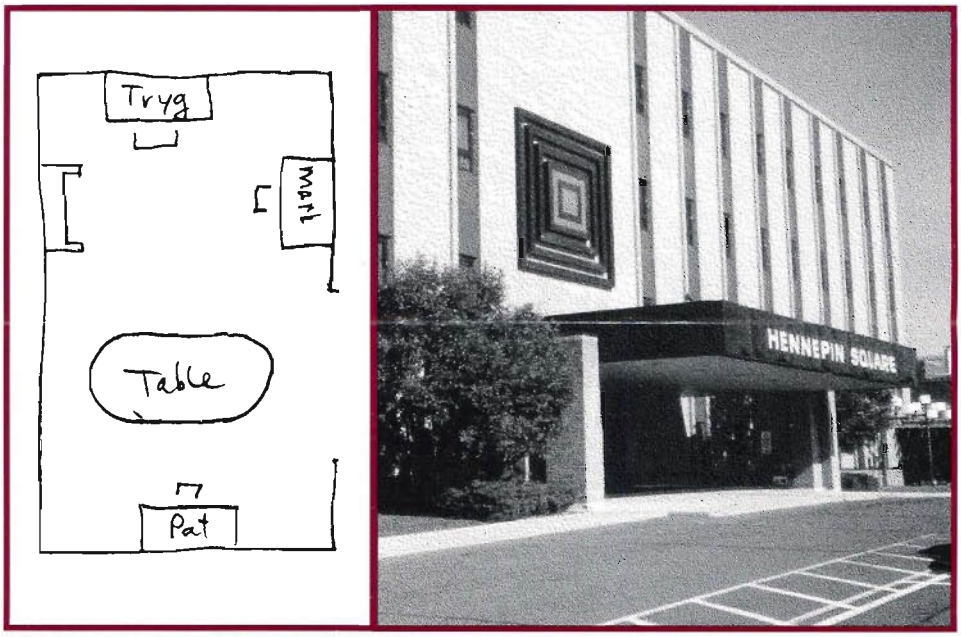
Design Evaluation**

Shows how to evaluate your design *before* it's run. Addresses aliased models, leveraged design points, orthogonality, degrees of freedom, multicollinearity, more. Two pages.

Taguchi Versus Standard Methods***

Taguchi stresses improvement, but without understanding. DOE isn't a substitute for good engineering. Interesting guide. Two pages.

**** Best for Design-Ease users.***
***** Best for Design-Expert users.***
****** Okay for anyone interested.***



HUMBLE START IN 1985 BECOMES HENNEPIN SQUARE TEN YEARS LATER -- The napkin layout *(left)* shows Pat Whitcomb's basement during Stat-Ease Corporation's infancy. Pat still leads as president today. The layout shows seating for Tryg Helseth and Mark Anderson, principals since the days of version 1. Our "Decade of DOE Excellence" moves into its *second* decade at our current location *(right)* just outside downtown Minneapolis.

"Genius without education is like silver in the mine." -- Benjamin Franklin

Discover how to discover... at a DOE workshop

Our remaining 1995 DOE workshops still have seats available at press time.

Experimental Design Made Easy workshops will be held in Minneapolis on September 12-15, 1995; and in Philadelphia on November 7-10, 1995.

Response Surface Methods for Process Optimization will be taught October 3-6, 1995 in Minneapolis.

Mixture Design for Optimal Formulations workshop is being held in Minneapolis on October 24-27, 1995.

Please call to preview any course outline or to ask about our highly rated workshops.

Toll Free: (800) 325-9807
Fax: (612) 378-2152
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"The Expert's Corner"

QUESTION: In Design-Expert version 4, once I've set up my "Response Optimization Worksheet" for Numerical Optimization (auto, for a mixture design), having filled in all my data, how can I print out a copy of the worksheet?

-- Chandra Webb
Genetics Institute
Formulation Development

ANSWER: Data entered into the Response Optimization Worksheet is displayed in the Design-Expert buffer along with the results of the optimization. You can print the contents of the Design-Expert buffer by pressing the F9-key when you are viewing the buffer.

-- Jim Mork
Lead Programmer

Hennepin Square, Suite 191
2021 East Hennepin Avenue
Minneapolis, MN 55413

STAT-EASE® INC.
"Statistics Made Easy"℠
Software • Training • Consulting

Toll Free: 800-325-9807
Fax: 612-378-2152 Direct: 612-378-9449
e-mail: 72752,2361@compuserve.com

Statistical Design Comes in From Right Field

Those of you who play softball will appreciate the dilemma posed by allowing for a tenth player in this amateur sport. Obviously, the extra fielder must go somewhere in the wide open spaces of the outfield -- but where? Most teams split the middle of the outfield into left-center and right-center. But others go to a roving short-fielder.

This latter option intrigued me. It offered a chance to break free from the restricted territory of the traditional outfielder. And going "short" would avoid strain on my broken-down throwing shoulder.

I dreamed of stealing hits with diving catches...

I fantasized snap-wrist throws forcing out unwary runners...

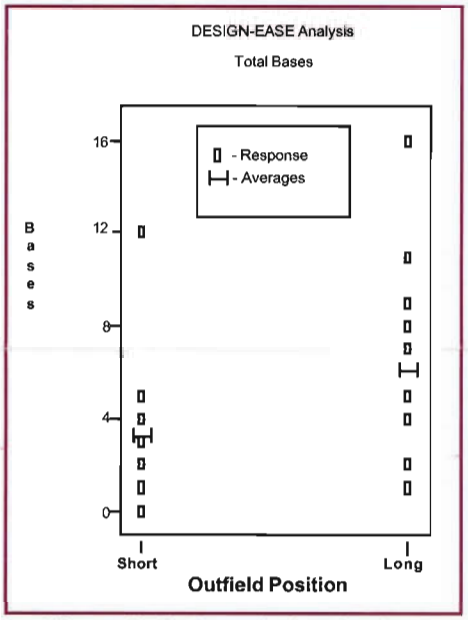
A roving short fielder? My earth-bound manager needed proof. So I concocted an experimental design to answer this question:

"Where should I position myself in Center Field – deep or shallow?"

I decided to measure *Total Bases*. This reflects the risk that stronger hitters can power the softball over the short-fielder -- accumulating doubles or triples. Total Bases count a base hit as one, a double as two, and so on. I didn't count walks or errors because these aren't impacted by an outfielder's position.

Using Design-Ease® software, I made a randomized test plan composed of outfield position by inning, blocked by games. Donning my Lake Wobegon Whippets hat (the team from Garrison Keillor's mythical Minnesota town), I headed for the field.

Look at the plot. It shows results and data from four games. Notice the big variation in the response. Despite this, with adjustments for blocks (game-by-game differences), statistical analysis reveals that short field positioning reduces total bases (>95% confidence). *(Note: Because of the range in total bases caused by overwhelming defeats in all but one of my games, I found it necessary to transform the response with a square root.)*



The results look convincing, but there are design flaws that may undermine the findings:

- Despite my protestations that it would detract from my DOE study, my manager insisted on tampering with the experiment by switching our fastest player to center field when I'd move to short field.
- Many opposing batters, most of whom rarely see a short fielder, tried unsuccessfully to adjust their swing. I suspect they'll adapt it after a few innings.
- One of the teams did adapt to the short field. In fact, they pulverized the ball over my head *several* times. A few of my less scientifically inclined team-mates became irate, but faced with ridicule as do all great scientific voyagers, I held my ground. The umpire finally relieved our misery by calling the game with only two outs. I took the results of their inning and increased it by 1.5 to simulate a normal three-out inning.

In future games I plan to move into the short field position. To be safe (and keep peace with my team-mates), I'll wait for the opposition's weaker part of the lineup to bat. I might rush in at the last moment to throw them off. Then I might fake left and race to the right when they try to poke the ball in the resulting gap. With an astounding leap, I'll snare the ball and rob another sure hit from the dumfounded batter.

Isn't it amazing what you can do with statistical design of experiments?

-- Mark J. Anderson

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- ☐ Taguchi versus Standard Methods

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Stat-Ease, Incorporated
Hennepin Square, Suite 191
2021 East Hennepin Avenue
Minneapolis, MN 55413-2723
Toll free: (800) 325-9807
Direct dial: (612) 378-9449
Fax: (612) 378-2152

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