

statease

ABOUT STAT-EASE® SOFTWARE, TRAINING, AND CONSULTING FOR DOE
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Workshop Schedule

Experiment Design Made Easy

January 27–29, 2009: San Diego, CA
February 24–26, 2009: Minneapolis, MN
March 31–April 2, 2009: Minneapolis, MN
Study the practical aspects of design of experiments (DOE). Learn about simple, but powerful, two-level factorial designs. \$1595 (\$1295 each, 3 or more)

Response Surface Methods for Process Optimization

March 10–12, 2009: Minneapolis, MN
Maximize profitability by discovering optimal process settings via RSM. \$1595 (\$1295 each, 3 or more)

Mixture Design for Optimal Formulations

February 3–5, 2009: Minneapolis, MN
Find the ideal recipes for your mixtures with high-powered statistical tools. \$1595 (\$1295 each, 3 or more)

DOE for DFSS: Variation by Design

May 5–6, 2009: Minneapolis, MN
Use DOE to create products and processes robust to varying conditions, and tolerance analysis to assure your specifications are met. A must for Design for Six Sigma (DFSS). \$1195 (\$995 each, 3 or more)

Designed Experiments for Life Sciences

March 3–4, 2009: Dulles, Washington D.C.
Learn how to apply DOE to Life Science problems. \$1495 (\$1195 each, 3 or more)

PreDOE: Basic Statistics for Experimenters (Web-Based)

PreDOE is an entry-level course for those who need to go back to the basics. See http://www.statease.com/clas_pre.html for more information. \$95

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

See page 3 for a profile on Stat-Ease contract trainer, Jim Alloway.



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Stat-Teaser • News from Stat-Ease, Inc.

Getting a Taste for Mixture Design via In-Class Experiments

One of the primary missions of Stat-Ease is to convince formulators of plastics, paints, chemicals, pharmaceuticals, foods or other blended products to consider using mixture design. I most recently introduced these statistical methods in my September 2007 article “Mixture Design Brews Up New Beer Cocktail—Black & Blue Moon.” Based on the unusually high number of responses, I suspect that many readers tried this experiment at home. However, it’s not one I’d recommend for a class on mixture DOE! Instead, I suggest the following experiment on flavored drinks—intoxicating only by how it generates an enthusiasm for planned experimentation on the part of future formulators.

On September 19th, I did a pro bono webinar for a crew of food scientist students assembled by their professor, Tyre Lanier, at North Carolina State University. This happened to be Talk Like a Pirate Day, thus sidetracking me somewhat on ‘sadistics’ such as ahRrrr-Squared. Tyre and his NC State crew patiently put up with my buccaneer banter as I delved into my analysis of their in-class concoction—a half liter (500 milliliter) orange drink consisting of:

- A. Flavor: 5 – 25 ml
- B. Citric: 5 – 25 ml
- C. Sucrose: 200 – 400 ml
- D. Water: 50 – 290 ml



Mark Anderson in an undisclosed location experimenting on fruit-flavored drinks

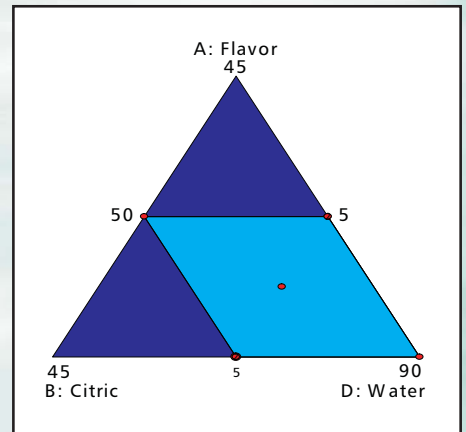
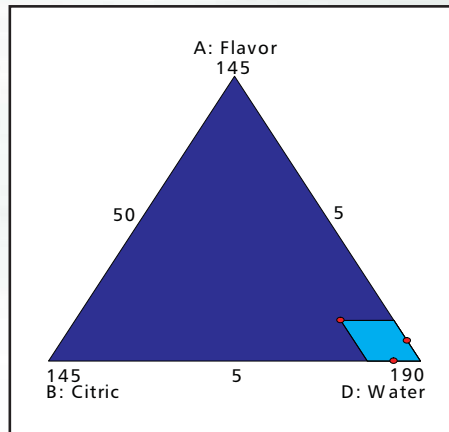
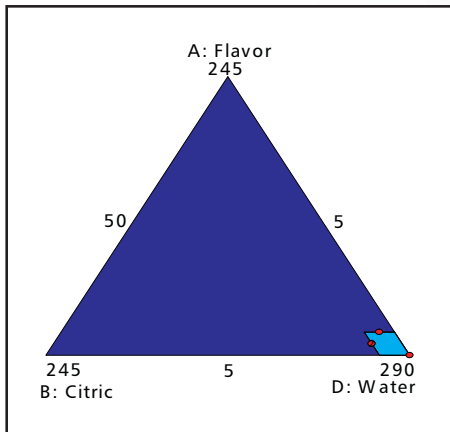
The treasure these tasters sought was 5 (just right) on a 0 to 10 intensity rating going from too little to too much. They scaled this against a commercial orange drink on the basis of four response attributes: orangeness, acidity, sweetness and overall.

Professor Lanier only wants to provide a taste (pun intended) of mixture design for optimal formulation. He had originally been introduced to this statistical method by a statistician from a DOE software publisher who went out of business some years ago. I was asked to come up with an equivalent design that could be analyzed after being done in class. When I showed our resident mixture-design expert, Pat Whitcomb, what Tyre had been doing, he said “not bad for them,” which actually is quite an accolade for him. However, the one element missing was replication of any of the experimental

—Continued on page 2

December 2008 • 1

—Continued from page 1



Figures 1 L, M & H: Design space for flavor, citric and water sliced at 200, 300 and 400 ml of sucrose

mixtures. Thus the design produced no measure of pure error—intrinsically useful for assessing reproducibility, but also necessary for generating a lack-of-fit test.

Given the constraints noted above it was very easy for me to use Design-Expert® software’s mixture design tools to set up a D-optimal selection of 10 blends, augmented with 3 additional unique mixtures for testing lack of fit (LOF) against 3 replicates. The program called for 5 each of the LOF and replicate points, but that put the total above the limit of 16 imposed by Tyre. That’s still a lot of orange to drink, but evidently acceptable to the 17 food science students (I suspect they had no choice—except maybe to walk the plank and fail the class!).

I laid out the experiment in 17 blocks by the taster’s name—they each tried the same 16 blends but in varying (randomized) orders. The design space forms a chamber within a three-dimensional tetrahedron. To provide some idea of this geometry, Figures 1 L, M and H provide three slices at the low, middle and high levels of sucrose; respectively.

Figure 2 shows one of the results of the

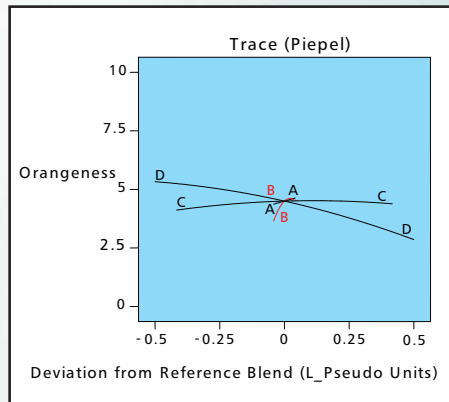


Figure 2: Trace plot for orangeness

taste test—a trace plot for orangeness. What Professor Lanier spotted was the surprising impact of citric, which I red-lined. This component (B) is much cheaper than the flavor (orange, of course). Notice that the flavor (A) slopes up, as one would expect. However, the slope for B (citric) is much steeper. It also curves, which may be of interest to a beverage formulator.

Furthermore, due to the impact of citric (B) on acidity it must be precisely controlled for hitting the desired intensity (level 5) overall. This can be seen on Figure 3.

I concluded my webinar presentation

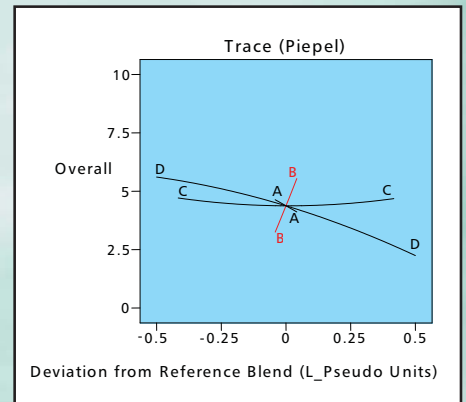


Figure 3: Trace plot for overall intensity

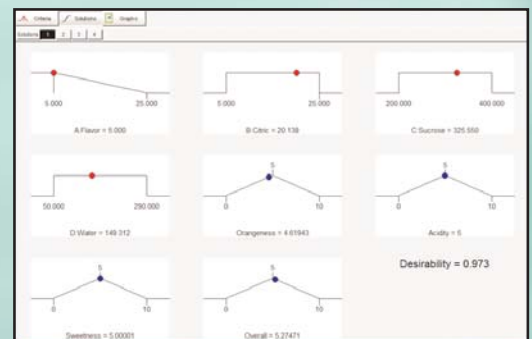


Figure 4: The ‘sweet spot’ for cheapest orange drink that hits the spot for intensity on all attributes

by performing a numerical optimization with Design-Expert. Knowing now that flavor is the most expensive ingredient, I set a goal to

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minimize this component (the less the better for maximum desirability). Figure 4 displays the sweet spot. It turns out that by loading up on citric and sugar the drink can achieve just the right intensity of orangeness with only the minimal level of actual flavor. This is achieved while maintaining the desired intensity of all attributes—most importantly the overall rating.

I am awaiting word on the results of confirmation tests—no news is good news. I am confident this predicted formulation worked, it always does for a well-done experiment with sufficient statistical power. In this case, by putting the entire NC State food science class crew to the tasting task, the design was replicated 17 times, with the natural up or down rating by people blocked out.

Being that I presented this talk on a day when one is encouraged to think like a pirate, I wonder if this orange drink would have been better than the rum-laden grog that was typically dispensed to the thirsty sailors. I am not a medical expert, but I suspect the citric might have lessened the scurvy, albeit it may be better to be toothless for the buccaneer look. One thing for sure, it's a lot safer nowadays to address a potentially surly crowd because it can be done via the Internet from a remote location, ideally kept secret. For example, if my predicted formulation creates 17 belly aches, I do not have to contend with it on a face-to-face (puckered up horribly, I imagine) basis—not that I'm concerned whatsoever. At any rate I am keeping a watch for the dreaded black spot that pirates use for serving notice of mutinous intentions. Can this be e-mailed?

—Mark Anderson, Principal
mark@statease.com

Introducing Dr. James Alloway, Jr.

Stat-Ease is delighted to introduce our newest contract trainer, Dr. James Alloway, Jr. (Jim). Stat-Ease has crossed paths with Jim numerous times in the past and has always been impressed with his enthusiasm for design of experiments (DOE), creativity in developing fun teaching tools, and cheerful demeanor. We are very pleased to have Jim as part of the Stat-Ease family.

Education and Experience

Jim holds a Ph.D. in Decision Sciences and Engineering Systems, as well as an M.E. in Management Engineering from Rensselaer Polytechnic Institute in Troy, New York. He also has a B.S. in Industrial Engineering from Northeastern University in Boston, MA.

With long-held positions in both industry and academia, Jim has developed a broad range of experience that serves him well as President and Founder of EMSQ Associates. Through his company, Jim consults with a variety of manufacturing, service, and healthcare organizations. He also uses his creativity and intellect to design, manufacture, and market statistical teaching tools (see Figure 1). Previous positions Jim has held include: Assistant Professor at Syracuse University in NY, Adjunct Professor and Instructor at Rensselaer Polytechnic Institute, Quality Engineering Consultant at United States Can Company in IL, and Senior Industrial/Process Engineer at EG&G Rotron in NY.

Jim has written and presented numerous papers and he wrote the book, "Spreadsheet Modeling," now in third edition by Prentice Hall. He won the Best Paper on a Technical Subject Award from ASQ in 1991 for "An Introduction to Multivariate Quality Control."

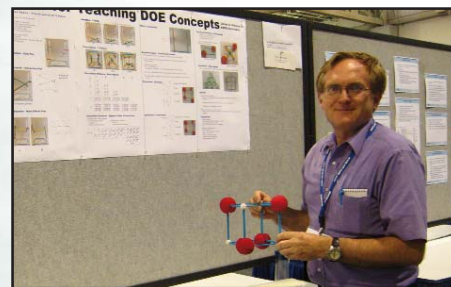


Figure 1: Jim Alloway demonstrating his teaching tools



Figure 2: Stu Hunter and Jim Alloway celebrate their shared birthday—6/3



Figure 3: Jim's daughter Alexis at 15,000 feet in Ecuador

Hobbies & Interesting Facts

- Jim served for 24 years as an Advanced Emergency Medical Technician (EMT) in community rescue squads in Upstate New York. An interest in healthcare runs in the family. His wife of 31 years, Janet, is a Physician's Assistant, his daughter Sandie is in nursing school, and his son Christian is an EMT and firefighter.
- Jim, his father, and his son are all

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Eagle Scouts. Despite his son having grown up, Jim is still involved in the Boy Scouts.

- Stu Hunter and Jim share the same birthday, June 3rd (see Figure 2).
- Jim's daughter, Alexis, is a Mountaineering Guide for the National Outdoor Leadership School. She is not only adventurous, but also an unintentional cover girl (see Figure 3).
- Jim has a workshop for woodworking, metalworking, and plastics—perfect for toy-making! Some of his toys include the Black Box for hands-on DOE exercises and construction toys that demonstrate the basic concepts of 3-dimensional models. See Mark's "Stats Made Easy" blog for more information on Jim and his Black Box. <http://statsmadeeasy.blogspot.com/2008/09/battle-with-black-box.html>.

For information on workshops, please refer to Page 1 or the Stat-Ease web site at www.statease.com. Welcome, Jim!

The New Stat-Ease® Support Forum

12/08

The screenshot shows the Stat-Ease Support Forum interface. At the top, there's a navigation bar with links for Home, Search, Register, Log in, and a user profile. Below that, a table lists various forum topics. The table has columns for 'Topics', 'Posts', and 'Last Post'. The topics are categorized into 'General Information', 'Design of Experiment (DOE) and Statistical Help', and 'Workshops'. The 'Design of Experiment (DOE) and Statistical Help' category has the most posts, with 117 topics and 274 posts.

Topic	Topics	Posts	Last Post
General Information			
FORUM RULES Please read the forum rules before posting! Moderators: Carp StatE	2	8	Mon Nov 24, 2008 8:23 am StatE
News & Announcements This forum contains administrative announcements and information. Moderators: Carp StatE	0	0	No Posts
Pre-Sales Questions Ask pre-sales questions. Moderators: Carp StatE	1	1	Wed Apr 16, 2008 8:06 am StatE
Suggestions & Feedback Have a suggestion about our Forum, our Customer Service, or Company? Should something be implemented differently, perhaps? Post your views here. Moderators: Carp StatE	0	0	No Posts
Design of Experiment (DOE) and Statistical Help			
FAQ's from DOE FAQ Alert Frequently Asked Questions from the DOE FAQ Alert newsletter. Moderators: Carp StatE	117	274	Mon Dec 08, 2008 6:22 am StatE
Design Selection I need help selecting or building a design to best fit my particular needs. Moderators: Carp StatE	2	8	Mon Dec 01, 2008 11:26 am StatE
Analysis Help with analyzing a design and interpreting the results. Moderators: Carp StatE	3	11	Wed Dec 03, 2008 5:18 pm StatE
Statistics General statistics questions relevant to experiment design. Moderators: Carp StatE	6	14	Tue Nov 25, 2008 4:22 pm StatE
Workshops What workshop best suits my needs? What do I need to know, and what will I learn? Moderators: Carp StatE	0	0	No Posts
How To / Tips & Tricks Moderators: Carp StatE	0	0	No Posts

The Stat-Ease Support Forum—<http://forum.statease.com>

Stat-Ease has created a new resource for customers looking for support and interaction with others interested in design of experiments (DOE). Categories of support include:

- General support
- DOE and statistical help
- Software support.

You'll find frequently asked questions (FAQs) on DOE, technical issues, and tips and tricks. Anyone can post questions and answers to the Forum. It is open for everyone to see (and is moderated). Check it out at <http://forum.statease.com> and weigh in!

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