

Systematic approach to product development

By **Anny Dentener**

Software package: CAMO *Guideline+*[®]

Function: Experimental design and analysis, multivariate data analysis and classification.

Website: www.camo.no or www.camo.com

Rating: ★★☆☆ (out of five stars)

Looking for help to sort out your food product or process development projects? Feel that you are going round in circles with trial and error experiments, or are under pressure from marketing, finance, production and quality control to achieve often conflicting objectives? The best way to address this is to use a systematic approach. The result will be better products in a shorter time. For a user-friendly approach software is in my opinion the only way to go. Of all available experimental design software (see article July 2001, FTNZ) *Guideline+*[®] is, as far as I am aware, the only one specifically designed for the food industry. However, it comes at a cost of US\$5,690 (approx. NZ\$12,500). So does it stack up?

For those less confident with statistics, it is best to use the guided option through design and analysis. *Guideline+*[®] literally guides you through the labyrinth of possible project designs. It shows in flowcharts where you are in projects (Figure 1), and on re-opening returns you exactly where you were last. It asks pertinent questions (Figure 2) to identify what problem you aim to address, whether your objective is a quick screening of possible factors, or identification of critical and maybe interacting factors that make the product perform.

Beyond experimental design, it can also unravel patterns in existing data, e.g. consumer or sensory research. I have only looked in detail at experimental design and analysis options. One of the first things to do when using *Guideline+*[®] is to run through some case studies to get a feel for its features. Run the Demo with 2 examples: one on multivariate analysis of sensory characteristics of raspberry jams as influenced by cultivar and harvesting time; the other describing the

experimental design and analysis to increase bread volume by adjusting processing steps. Note: Help files refer to other food industry cases but they appear to only be accessible when they relate to similar stages of your projects. Free access to examples would be better.

The software has excellent notes and comments at many points of the programme. I especially liked: "...it is not recommend that people with too high a hierarchical status should take part in a brainstorming session. Focus on people with operational knowledge and direct practical involvement...". When guided through the software there are many loops back in case you need to rethink your options.

Missing in the programme is an easy total project overview, and the option to quickly flick through all its facets. When setting up a design I found it frustrating that I could not quickly retrace my steps. Several "undo" levels or asking for "save changes as" would be a welcome addition. In practical terms it is easier to start a new design rather than redoing the old one. My file box now has several variants of the same projects. In the design stage it is possible to group experimental runs, e.g. all runs that go into an oven at one particular temperature, so there is no need to reset the temperature for nearly every run. "Blocking" is also possible which is helpful if you cannot do all experiments on the same day, and you want to check for a systematic shift.

Two niggles with the programme: a concentration of 0.08 gets a default reset to 8×10^{-2} , and only 10 characters can be used for response names resulting in odd abbreviations. The information at the design stage gives a good "DOE 101" guideline on how to "Create a Design" and how it differs from the classical "one variable at a time" approach. For screening designs both level and distinct categories can be entered so you can compare not only concentration, time, or temperature, but also different suppliers, times of the season, mixer A or B, and so on. It also urges you to break down the project into smaller,

manageable steps and to avoid the use of one big and unwieldy project.

The significant "mixture design" option is unfortunately only available in the non-guided section which limits the usefulness of the programme. Mixture designs, where ingredients have to add up to 100%, are particularly relevant to the food industry. Using the non-guided mode, a screening design for a chicken burger showed only 10 runs were needed. A full optimisation using 29 unique runs and 3 centerpoints covered all possible combinations within boundaries set on the ratio of 3 meat types and varying time, temperature and additive levels.

However, how to analyse the results was rather unfathomable to me, even more so since the Help file does not have any information on mixture designs. For *Guideline+*[®] to deliver a complete package to the food industry it is essential that mixture designs are incorporated into the guided section.

The programme generates a "lab report" which is not that user friendly, and it is best to work with trial info pasted into Excel. Having the results also in Excel allows a straight copy back into *Guideline+*[®], with no need for manual entry. Results can be entered from other sources such as statistical programmes. The programme can study individual panellist's' performances and incorporate averaged sensory analysis data into the results.

Having entered trial results I was itching to discover significant variables but *Guideline+*[®] stopped me in my tracks. Based on the premise that a results table usually contains at least one error which should be detected before you continue the analysis, the programme first uses statistical parameters to check for these errors and gives you a chance to correct them. This is a tedious and slow process, with several steps and corrections options.

A good point is the explanatory notes available with each graph to help you understand it. Unfortunately default graph scales are often awkward, e.g. scales are given full size so that the hot viscosity of a custard is lost next to its cold viscosity. The quality of the graphical output of the results is a bit disappointing and not up to client reporting standard. Results are also very limiting from a practical viewpoint since there is no graphical option for screening trials to plot different factors against each other, and to obtain predictions on how all combinations of ingredients and process conditions affect results.

With further optimisation trials it is possible to have a closer look at significant factors and how they interact. Contours of results plotted against input variables (like contour maps for a mountain) are illustrative and the "landscape" plots show the lay of the land. Graph options are again limiting as *Guideline+*[®] does not let you find minimums and maximums in the graphs as easily as other programmes do.

Predictions are only possible on each separate graph but not with a separate prediction option for all results. The button to manipulate the response surface landscape plot is clumsy and frustrating. With experimental design often the conclusion is that all objectives can be achieved some of the time but not all at the same time, and a compromise will have to be found. Other programmes (see future reviews) offer optimisation where the best "trade-off" combination can be found. *Guideline+*[®] only offers a visual interpretation of the graphs. Their suggestion is to print off the graphs on overhead sheets and superimpose them to find the best point. I strongly suggest that *Guideline* addresses this omitted feature.

References obtained are from one company where the package is run by one dedicated staff member for the rest of the R&D staff, whilst the other company has 10 people using it. They find it fairly easy to use in their development and sensory work. One notes that the software is used in 30-40% of all development projects, that they save a lot of work and get better results with it. They mention that the guided section for the design part is easier to understand than the analysis part. Both recommend that staff have good statistics skills, with one suggesting to run other statistical software alongside. Technical support is rated as "good" and "very good" and they would recommend the software to others in the food industry.

Overall the software can be of great assistance in helping solve a wide range of typical R&D, QC, production and sensory/consumer problems. Its guided part is a good safety net to help you get over that "scared of stats" first hurdle. It has many strong points, but weaknesses too and it does not absolve you from needing some statistical knowledge, contrary to what the concept of "guided" might make you believe.

Guideline+[®] was developed by CAMO in co-operation with Matforsk, the Norwegian Food Research Institute, and The Norwegian Dairies. While fairly stable on my Windows98 system, it locked up a few times. Check their web site for demonstration tours and further details on the software, and other CAMO packages for experimental design and multivariate analysis.

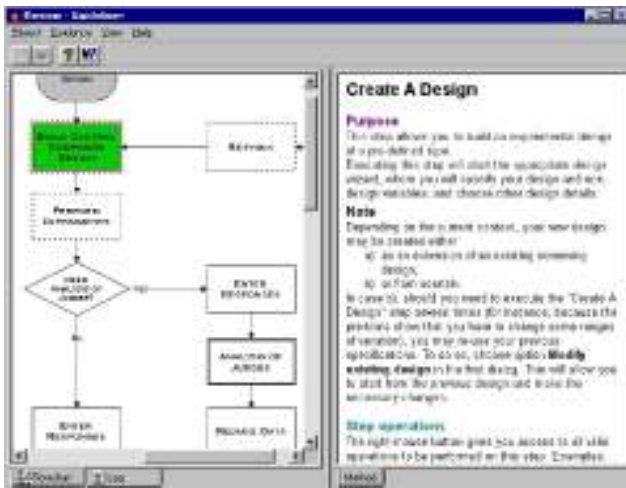


Figure 1: Flow chart at design stage, showing option to include sensory data.



Figure 2: Example of questions asked by Project Wizard in guided mode.

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