Cake Mix

A producer of cake mix wanted to minimise taste variations in the final product, while maintaining low production costs.

This is the perfect example of a successful application of design of experiments, where the result was improved to an even lower cost than before. The key to success was an important interaction between two ingredients.

Q   How was taste improved and at what cost?

A   Eleven experiments were performed according to a full factorial design, with changes in the amounts of flour, shortening and egg powder. A trained sensory panel tasted all cakes and graded them.

The investigator found that the taste indeed could be improved. The previous standard recipe got a grade of 4.7 from the sensory panel, but other cakes in the design got grades up to 5.8. The best tasting cake was however also increasing production costs from 4.4 to 5.1 SEK per cake, which was unacceptable.

The contour plots to the right showed that a better solution was to be found at the lower right corner of both plots. Then, the taste was increased to the more moderate 5.2 but at a reduced cost of only 4.2 SEK. Hence it was possible to improve the taste of the previous standard recipe at lowered production costs!
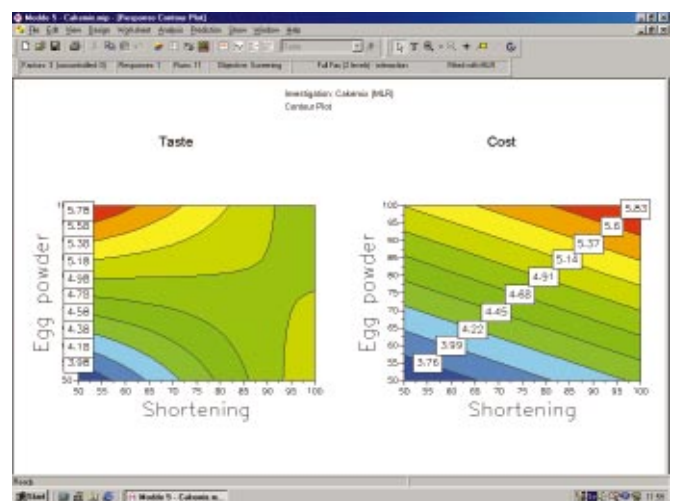

Q   Which ingredients are important?

A   A plot of the regression coefficients showed that egg powder was the most important of the three ingredients (third bar from the left). But there was also an interesting interaction between shortening and egg powder, which made the contour levels twist in the taste contour plot (fourth bar). Thanks to the interaction, it was possible to achieve a better taste at lowered production costs.
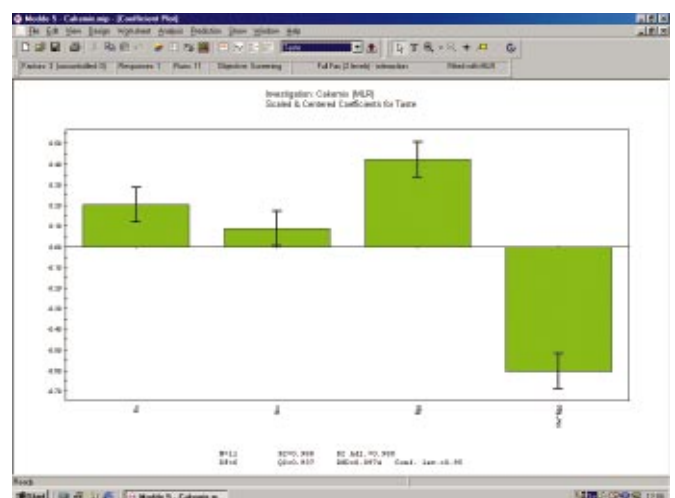
Getting started in MODDE

1. Activate the Design Wizard for guidance through the procedure of defining the experimental situation.
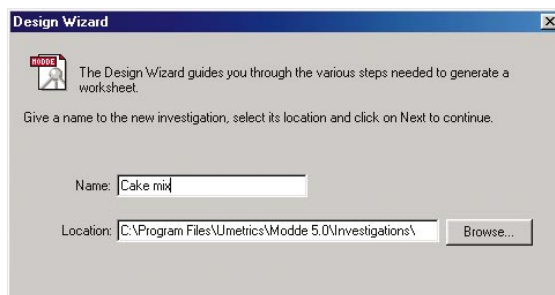

2. Define factors with suitable intervals. Factors can be quantitative, quantitative multilevel or qualitative.

3. Define responses as regular, derived or linked.

4. Select a design from the list of suggestions in MODDE. The classical designs have a fixed number of experiments, but it is also possible to define the maximum number of experiments and then allow MODDE to tailor-make a solution for that specific problem (D-optimal design).
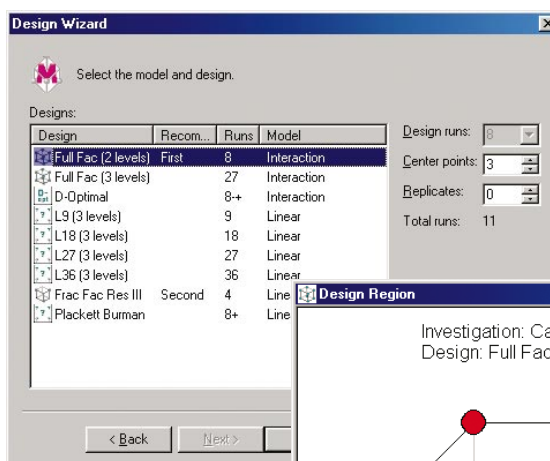
5. The geometry of the design region is seen in the Design region plot. Every corner of the cube is an experiment to execute, plus at least three replicated centre points (not shown in the plot).
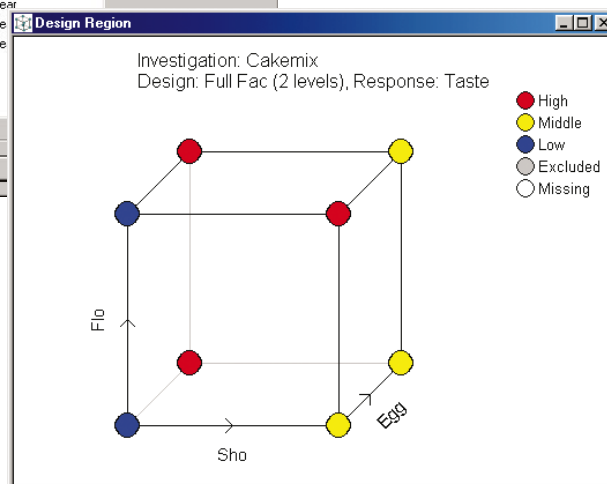
Reference: Box, G.E.P., Personal communication

MODDE is our state-of-the-art Windows-based software, providing design of experiments, analysis and optimisation in one comprehensive, user-friendly package.

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