

# DOE Perspectives

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## Experiment Strategies

### How to Choose a Model

Choosing a model can seem difficult if you are new to DOE. A few simple guidelines can help make this the easiest part of the process.

Before we talk about these guidelines, let's review our model options.

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*Budget will drive your choice of model. If you can afford it, use a quadratic model. If your budget is tighter, use an interaction model.*

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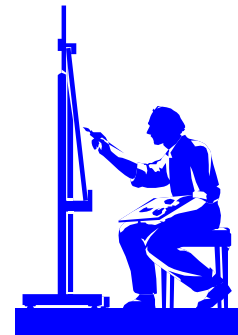
First, we have the Main Effects model. This model doesn't include any interactions or curvature. Second, we have the Interaction model. This model can include many interactions and can model some curving, but it doesn't model domes and basins. Third, we have the Quadratic model which models interactions, curv-

ing, and domes and basins. Other models exist, but these three should cover the bulk of the work you will perform. Figures 1 and 2 show examples of Interaction and Quadratic models.

#### The Guidelines

The following guidelines should help you to choose a model quickly.

- 1 If you have more factors to study than your budget allows, you will want to choose a Main Effects model for screening. This is a dangerous choice of model because it ignores interactions. Interactions are very common. Use this model only if your budget forces you to. Be sure to follow-up with a study of the remaining factors using a better model.
- 2 If you have a tight budget you can use an Interaction model. This is a good model



which will work well in many situations. If you discover later that you have a dome or basin to fit, you can collect some more data and fit a Quadratic model.

- 3 If your budget will allow it, use a Quadratic model. This model is the workhorse of industrial DOE. It will work well for most problems encountered in industry. If you use an I-Optimal design you can fit this model with only a few more trials than an Interaction model needs.

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# How to Choose a Model

## The Choice is Simple

Budget will drive your choice of model. If you can afford it, use a Quadratic model. If your budget is tighter, use an Interaction model. If you are on a very tight budget, screen using a Main Effects model and follow up with a study of the remaining factors using an Interaction model.

Now you can spend your time experimenting instead of trying to pick a model.

**About the author:** Bill Kappele has used DOE and RSM in his work in industry for 9 years. He has 10 patents with three pending, most of which resulted from the use of

DOE. Bill is currently the President of Math Options Inc. Math Options provides people with options to doing math while still benefiting from it. Bill teaches people simplified applications of mathematics for industry including the class “Performing Objective Experiments” which teaches the basics of DOE and RSM. You can reach Bill at (360) 293-6860 or send him E-Mail at [Bill@MathOptions.com](mailto:Bill@MathOptions.com). You can visit the Math Options Web Site at [www.MathOptions.com](http://www.MathOptions.com).

success story you’d like to share? Have you discovered any new or helpful insights that you’d like to share? Have you developed a useful figure of merit? Would you like to tell us how you got started using DOE, or how it has helped your career? We’d love to hear from you!

Please send your ideas for an article or your completed articles to:

Experiment Strategies  
1308 18th Street  
Anacortes, WA, 98221  
Attn: Dave Doehlert

OR

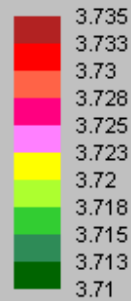
## DOE Perspectives is looking for authors.

Do you have a DOE

In Microsoft Word Format to:  
[Davedoe@fidalgo.net](mailto:Davedoe@fidalgo.net)

# Experiment Strategies

Remaining Factors  
PRESS = 18



Confidence Limits				
-1.0	-0.5	0.0	0.5	1.0
0.02	0.01	0.01	0.01	0.02
0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01
0.02	0.01	0.01	0.01	0.02

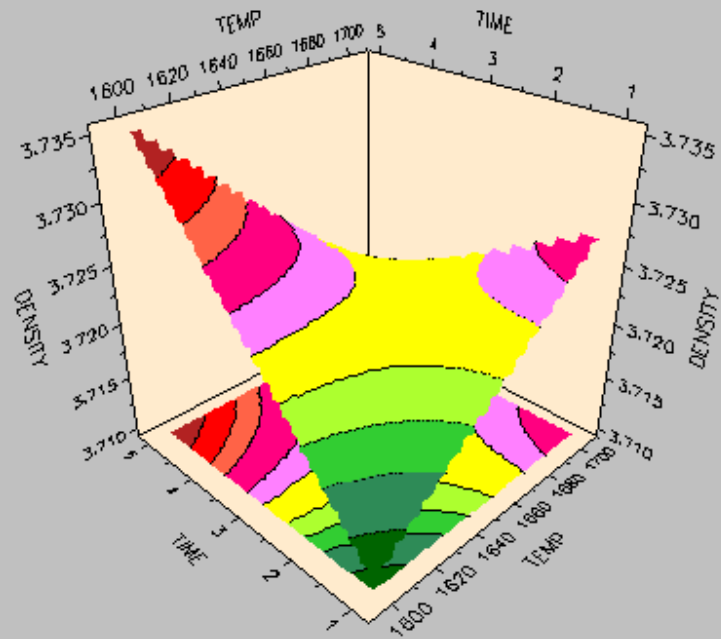
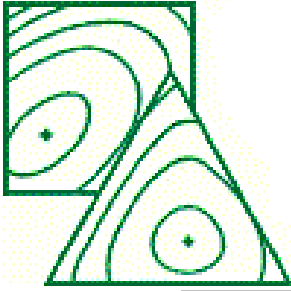


Figure 1 — A typical Interaction model.

# How to Choose a Model



## Experiment Strategies

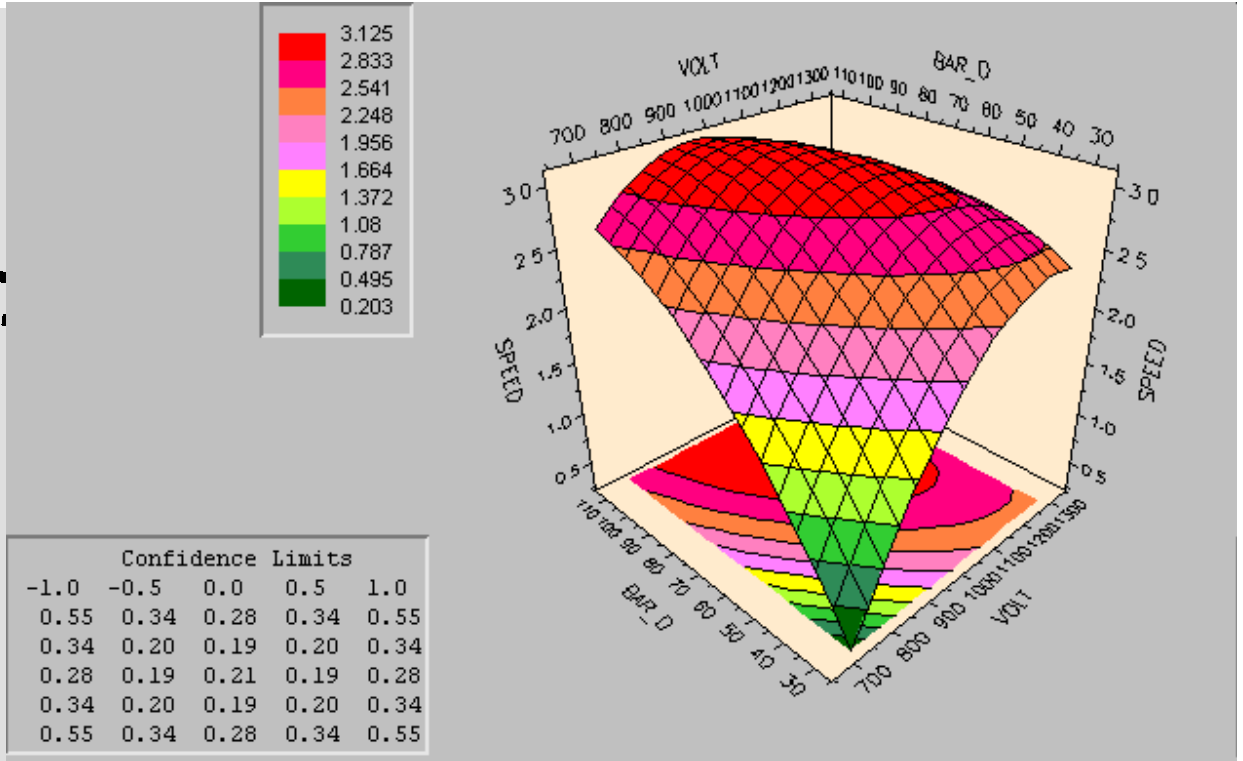


Figure 2 — A typical Quadratic Model

## Notices

Process Builder and Math Options have teamed up to offer a free design check service. Send them your design before you collect data and they will tell you the quality of the design for free! Send them your design with data and goals and they will tell you if they can find a sweet spot. You can find out more about it at [www.mathoptions.com/free.htm](http://www.mathoptions.com/free.htm)

Process builder has just released a Windows 98 compatible version of STRATEGY. Please contact Richard Nash at (206) 364-5740 to get a copy.

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