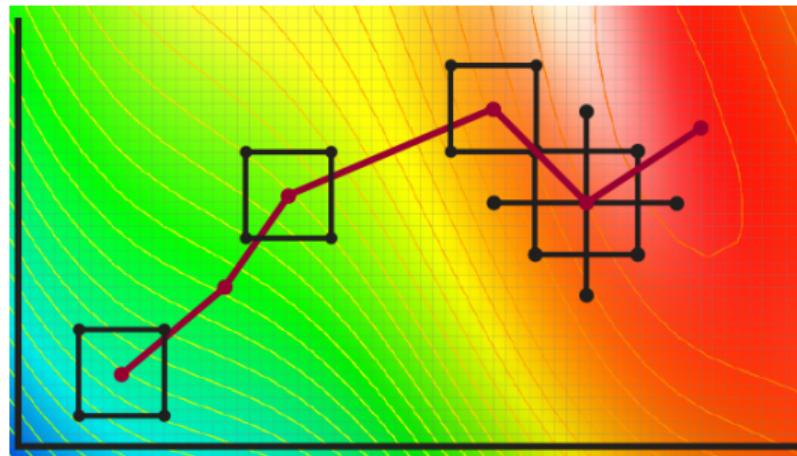


# Experimentation for Improvement



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<http://learnche.org/>

Design and Analysis of Experiments

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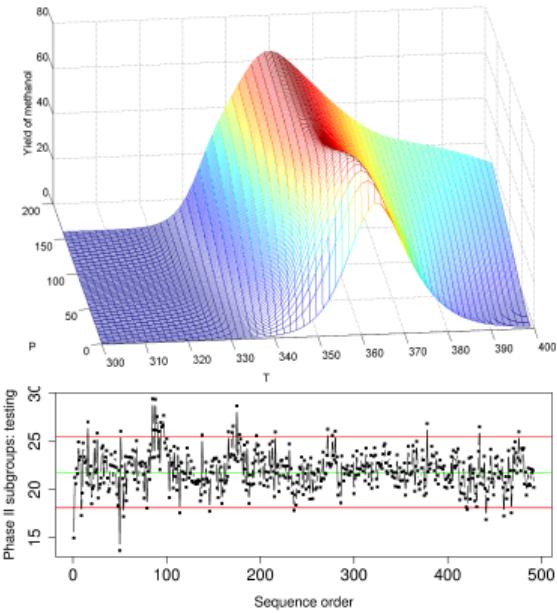
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# Achievable objectives when improving a process – based on data

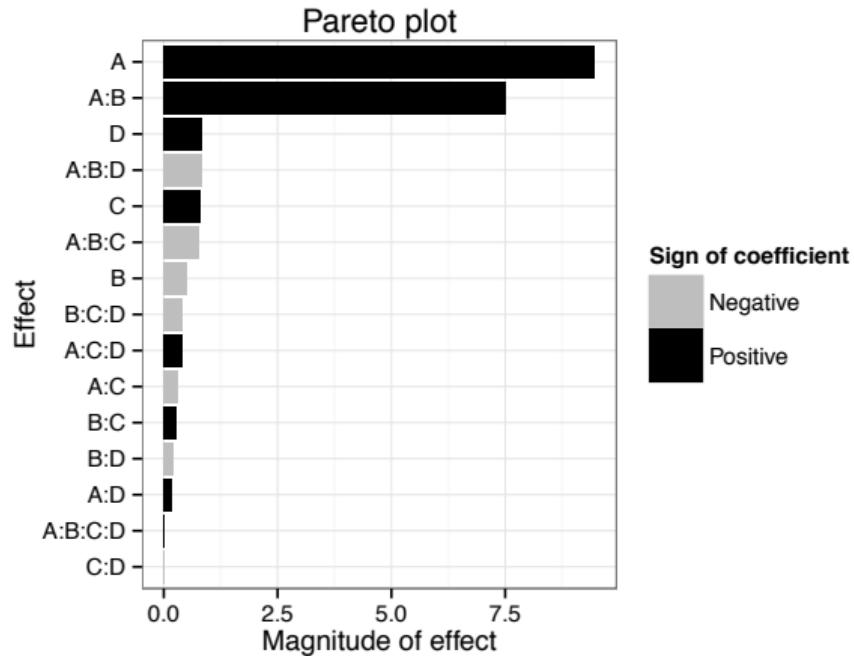
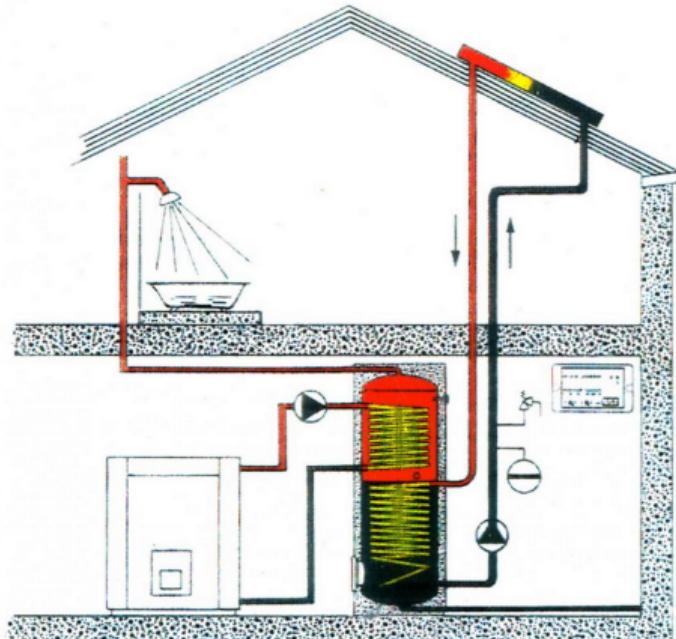
1. learn more about, and increase your understanding
2. troubleshoot a problem
3. make predictions
4. try to optimize the process
5. monitor the system to ensure performance gains are retained

Think back to your prior projects;  
what were your objectives?



Always have a clear objective in mind

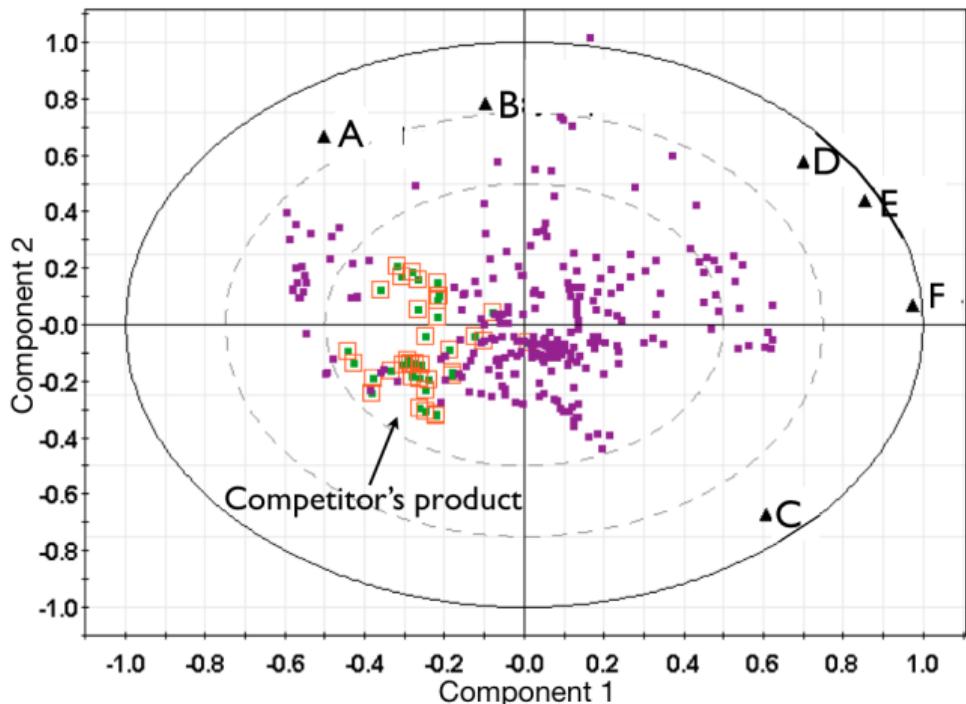
# 1. Learning more and increasing our understanding



[<http://yint.org/solar-panel-study>]

We studied this example earlier.

## 2. Troubleshooting a difficult problem in your company



Why is **my company's product** (purple) so different from my **competitor's**?  
I'm losing customers because of this!

### *Potential causes:*

- ▶ raw material has become more brittle
- ▶ seasonal variability affects our process
- ▶ we are operating at slower rates
- ▶ was it the move to higher pressures last month
- ▶ the new staff that we hired?

### 3. Making predictions from your data



### Taste results prediction model

Taste prediction for **molasses**, and baking for **8 minutes**

$$\begin{aligned}y &= 5.25 & \hat{y} &= 5.25 \\&+ 1.75x_A && + 1.75(-1) \\&+ 1.25x_B && + 1.25(+1) \\&+ 0.75x_Ax_B && + 0.75(-1)(+1)\end{aligned}$$

$$\hat{y} = 5.25 - 1.75 \underbrace{+ 1.25}_{\text{sugar type's contribution}}$$

## Back to making popcorn



[Flickr: ed\_welker]

## Back to making popcorn: our factors, and our objective function



[Flickr: skaty222]

Space for animated calculations here

# What “Response Surface Methods” are all about

Sequential groups of experiments  
to create empirical models  
to reach an optimum  
efficiently  
using only factors that affect your outcome

