FINDING THE RIGHT BALANCE WITH EFFICIENCY AND EFFECTIVENESS

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JMP STATISTICALLY SPEAKING

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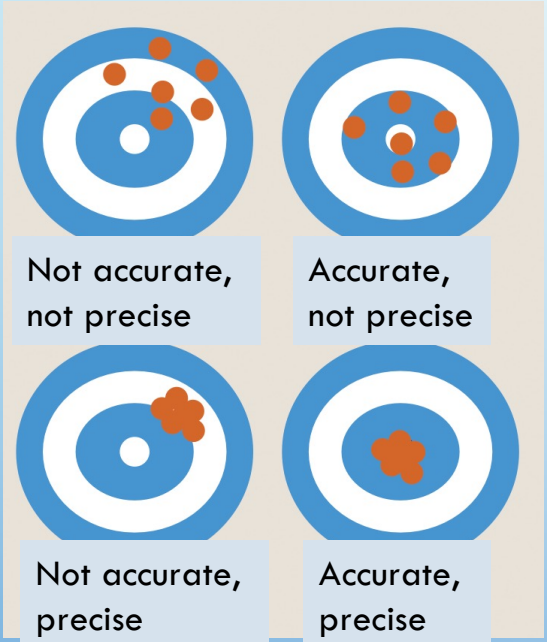
Efficiency (Optimal) without Effectiveness

Effectiveness without Efficiency

What do we mean by "Efficiency" and "Effectiveness"?

"Efficiency" = using time, money, effort in most productive way, avoiding waste, good value for resources

"Effectiveness" = achieving the right outcome, solving the right problem



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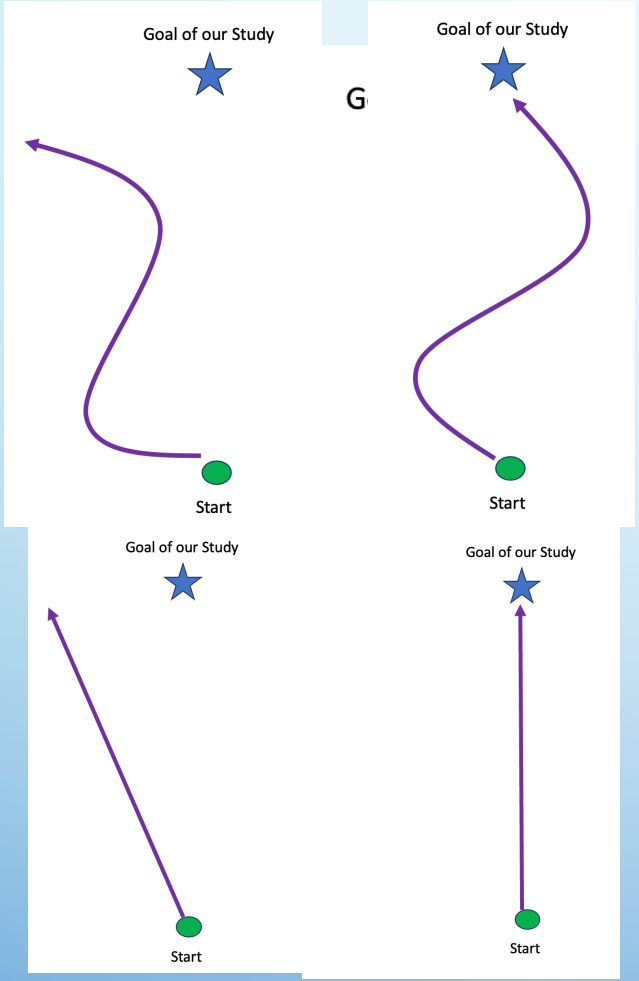
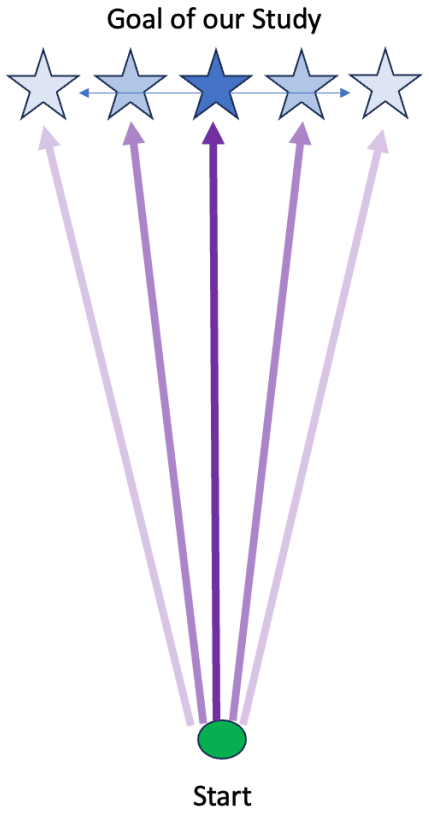


Scenarios where applicable:

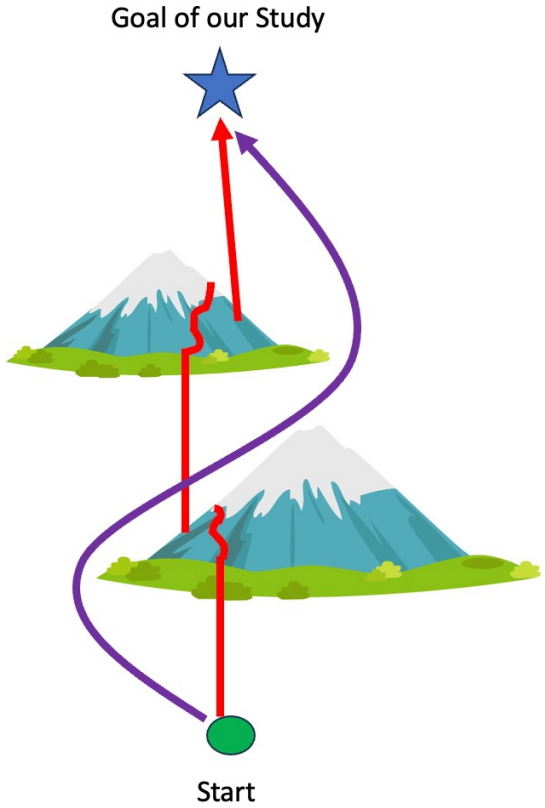
- Executional Effectiveness and Efficiency
- Collaborative Effectiveness and Efficiency
- Statistical Effectiveness and Efficiency

A very short talk, without ……

- Uncertainty



- Constraints/Complications



Why do we hear so much more talk about efficiency?

Efficiency is Quantitative – much easier to compare options, measure our success.
Time, effort and cost are metrics we use all the time.

Effectiveness requires articulating our goals and objectives, which is hard.
It is even harder when several people are involved.

Tools we use for efficiency are reusable and transferable.
The goals / objectives of each study need to be reconsidered each time.

Quotes

"Far better an approximate answer to the right question, which is often vague, than an exact answer to the wrong question, which can always be made precise." John Tukey, statistician

"Efficiency is the foundation of survival. Effectiveness is the foundation of success."
John C. Maxwell, leadership expert

"When it comes to efficiency and effectiveness, I would always start with effectiveness. I am interested in achieving a certain outcome. Only secondarily do I worry about achieving it as efficiently as possible." Philip Kotler, marketing expert

How to Balance ~~Efficiency~~ and ~~Effectiveness~~

1. Effectiveness 2. Efficiency

Focus on Effectiveness:

Start by thinking critically about objective(s) Strategy before tactics & tools

Structured Approaches to:

Process Improvement

DMAIC (Define-Measure-Analyze-Improve-Control)

Designing New Processes / Products

DMADV (Define-Measure-Analyze-Design-Verify)

Decision Making

DMRCS (Define-Measure-Reduce-Combine-Select)

Then on Efficiency: Think about how to accomplish this efficiently

Design of Experiments Example

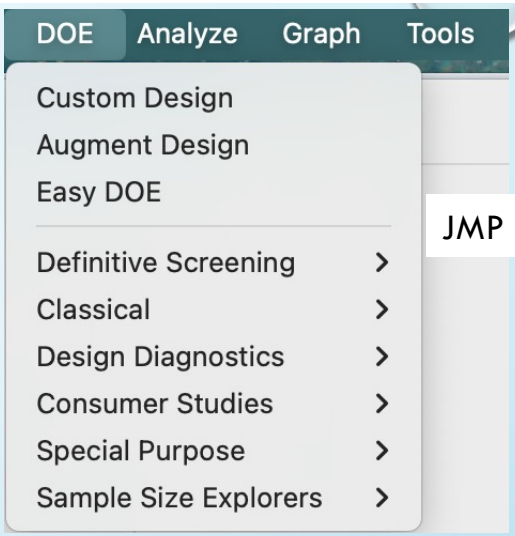
Step 1: Choose goals for experiment:

- Exploratory / Screening designs
- Characterization (RSM) designs
- Space-filling designs
- Confirmatory experiments

Step 2: Select a good design within that category to match budget, resources and constraints

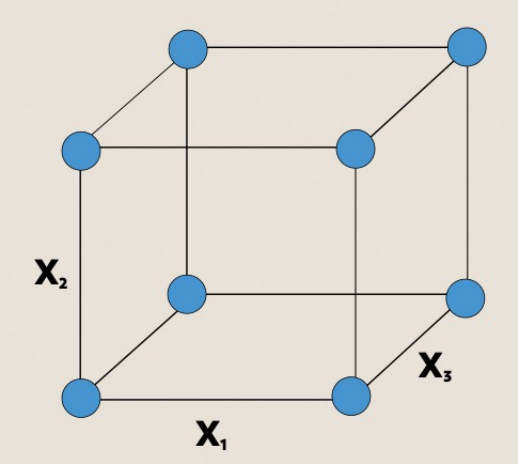
Step 3: Fine-tune the choice to better match the scenario

Optimal/Efficient only makes sense for a specific criterion

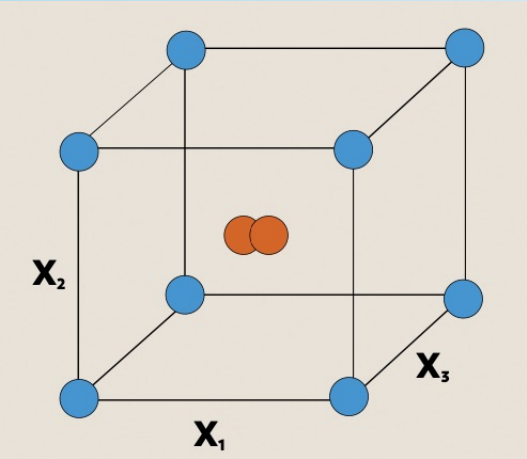


JMP DOE menu

Design of Experiments Example



Screening: Optimal design for estimation of main and interaction effects for 3 factors (8 runs)



Alternative:
- 10 runs
- Curvature check
- Natural variability

Modeling Example

Step 1: Think about explaining vs predicting:

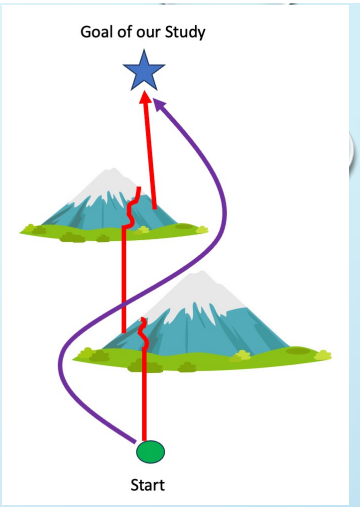
- Explaining: focus on gaining understanding, perhaps to manipulate or improve the system
- Prediction: focus on best possible prediction of new observations

Shmueli, G. (2010)"To Explain or To Predict"

Step 2: Match the tool to your objective:

- Explain → Interpretable tools (response surface methodology)
- Predict → machine learning tools

Strategies for Effectiveness and Efficiency

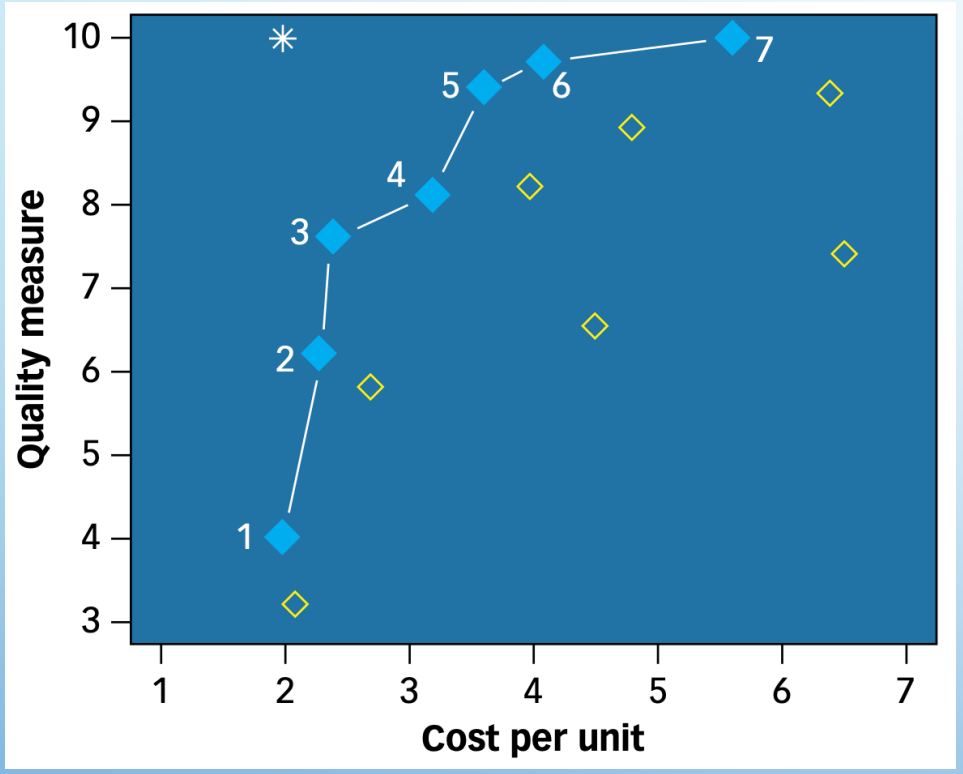


Strategy 1: Invest in interdisciplinary teamwork

- Building the right team is perhaps the most important step of problem-solving
- Have diverse interests represented
- Develop collaboration skills to be able to elicit different priorities
- Use a structured process to keep team on track
- Practice translating goal into quantifiable metrics

Strategies for Effectiveness and Efficiency

Strategy 2: Consider more than one objective

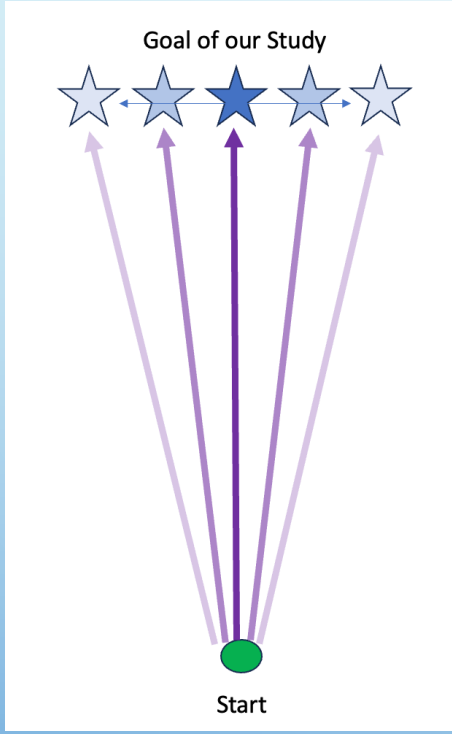


Pareto front for sensible choices

See choices to evaluate trade-offs in context

Strategies for Effectiveness and Efficiency

Strategy 3: Tackle problems sequentially (data, learn, react, data, learn, ….)



Strategies for Effectiveness and Efficiency

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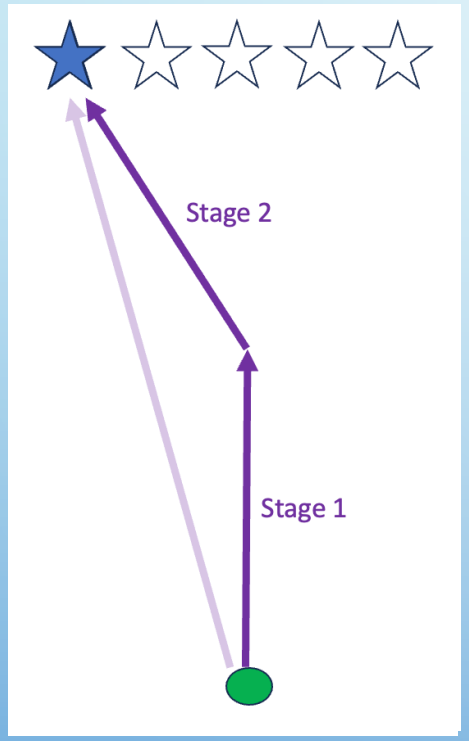
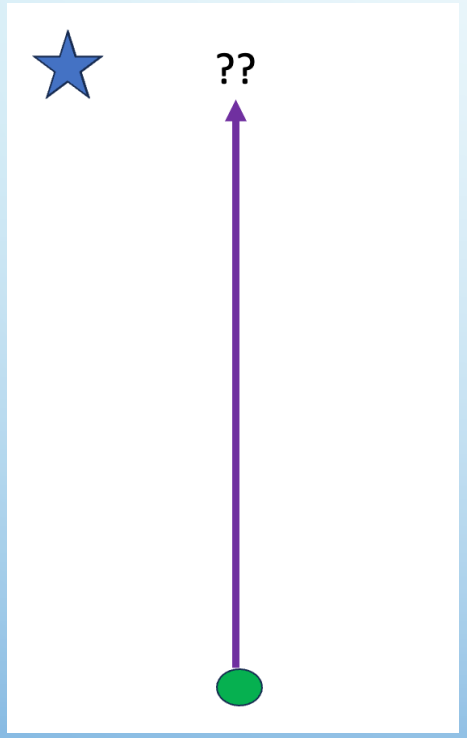
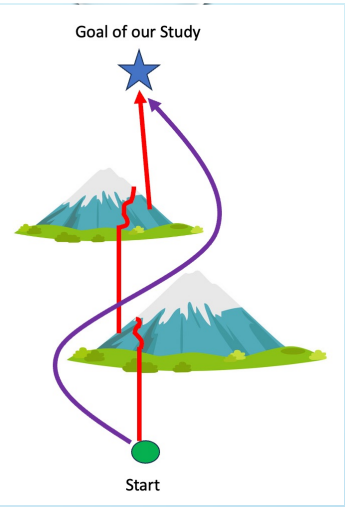




Strategies for Effectiveness and Efficiency

Strategy 4: Think hard about what can go wrong



Identify obstacles that can keep you from achieving your objectives

- Incorrect assumptions
- Problems collecting data
- Changing resources (personnel, timeline, budget)
- Shift in management priorities

Be willing to trade some efficiency (if everything went right) for protection against most pressing of obstacles

CONCLUSIONS

- Think about **Effectiveness** before **Efficiency**
- Invest in really understanding what success looks like (with the right interdisciplinary team)
- Its much easier to be efficient if you know what you are doing! If you are still learning, then emphasize effectiveness and a path to success
  - Sequential learning
  - Multiple objectives (efficient & protection)
- Find the right balance for each problem

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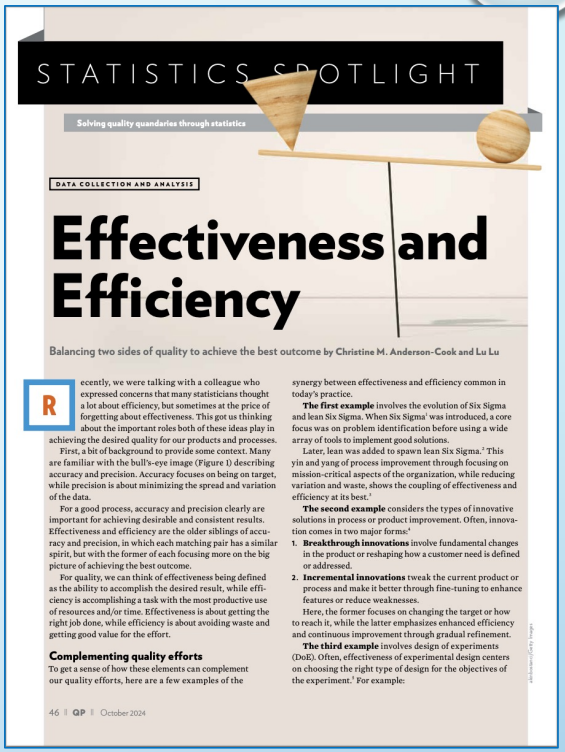

STATISTICS SPOTLIGHT

Solving quality quandaries through statistics

DATA COLLECTION AND ANALYSIS

Effectiveness and Efficiency

Balancing two sides of quality to achieve the best outcome by Christine M. Anderson-Cook and Lu Lu

Recently, we were talking with a colleague who expressed concerns that many statisticians thought a lot about efficiency, but sometimes at the price of forgetting about effectiveness. This got us thinking about the important roles both of these ideas play in achieving the desired quality for our products and processes.

First, a bit of background to provide some context. Many are familiar with the bull's-eye image (Figure 1) describing accuracy and precision. Accuracy focuses on being on target, while precision is about minimizing the spread and variation of the data.

For a good process, accuracy and precision clearly are important for achieving desirable and consistent results. Effectiveness and efficiency are the older siblings of accuracy and precision, in which each matching pair has a similar spirit, but with the former of each focusing more on the big picture of achieving the best outcome.

For quality, we can think of effectiveness being defined as the ability to accomplish the desired result, while efficiency is accomplishing a task with the most productive use of resources and/or time. Effectiveness is about getting the right job done, while efficiency is about avoiding waste and getting good value for the effort.

Complementing quality efforts

To get a sense of how these elements can complement our quality efforts, here are a few examples of the synergy between effectiveness and efficiency common in today's practice.

The first example involves the evolution of Six Sigma and lean Six Sigma. When Six Sigma[1] was introduced, a core focus was on problem identification before using a wide array of tools to implement good solutions.

Later, lean was added to spawn lean Six Sigma.[2] This yin and yang of process improvement through focusing on mission-critical aspects of the organization, while reducing variation and waste, shows the coupling of effectiveness and efficiency at its best.[3]

The second example considers the types of innovative solutions in process or product improvement. Often, innovation comes in two major forms:[4]

1. **Breakthrough innovations** involve fundamental changes in the product or reshaping how a customer need is defined or addressed.
2. **Incremental innovations** tweak the current product or process and make it better through fine-tuning to enhance features or reduce weaknesses.

Here, the former focuses on changing the target or how to reach it, while the latter emphasizes enhanced efficiency and continuous improvement through gradual refinement.

The third example involves design of experiments (DoE). Often, effectiveness of experimental design centers on choosing the right type of design for the objectives of the experiment.[5] For example: