Rational Subgrouping

Nature and Purpose of Rational Subgrouping

If I cannot predict the next deviation, it is random.

(Deviation)

If I can predict the next deviation, it is not random.
Total = Random + Assignable Causes

Total Contains Assignable Causes + Random Causes
Rational Subgrouping

Impact of Sample Size on Subgroup Statistics

\[ Y_d = f(X_1, X_2, X_3, \ldots, X_n) \]
Rational Subgrouping

Change Die in Machine (*an assignable cause*)

Subgroup A

Subgroup B

Time

Random

Rational Subgroup

Not Random

Rational Subgroup

Random
We want Random Variation to appear “within” subgroups.
We want Assignable Causes to appear “between” subgroups.

\[ g = 3 \]
\[ n = 5 \]

\[ Y = f(X_1, X_2, X_3, \ldots, X_n) \]
Some X’s are Assignable and some are Random.

\[ V_{\text{Total}} = V_{\text{within}} + V_{\text{between}} \]
Is there a signal in all this noise?

If I could straighten the signal out my variation would be less:

\[ Y = f (X_1, X_2, X_3, \ldots, X_n) \]

Find the “X’s” that have impact on the signal.

“n” big enough to see the noise yet small enough to see the signal above the noise.
Rational Subgrouping

Use of Rational Subgrouping with Control Charts

\[ V_{\text{Total}} = V_{\text{within}} + V_{\text{between}} \]

- SIGNAL
  - The is the Between Group
- Noise
  - The is the Within Group
Rational Subgrouping

Use of Rational Subgrouping with Experimental Design

Design of Experiments

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<tr>
<th>A</th>
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Groups

Pool 1

Pool 2

Random

Control Charts

σ Pool 1 Data

σ Pool 2 Data