Rational Subgrouping

Rational subgrouping is the process of organizing data into groups of items that were produced under similar conditions in order to measure the **variation between the subgroups instead of between individual data points**. The organization of subgroups is generally established to sample a subset of the population within relatively homogeneous conditions -- a short duration of time (shift), or a small region of space (machine) or a designated amount of output (batch).

The subgrouping strategy directly determines the sensitivity, and therefore the usefulness, of the control chart by bearing on the sampling plan for the charts. Without a rational subgrouping strategy, the control charts will not answer the right questions related to identifying the source of variability of a process.

When is it used?

- Employed when sample data from a process is used to make decisions, but especially when using control charts to develop the data serving as the foundation for those decisions.
- Used to answer the following questions generally during the Measure phase of a DMAIC project:
  - Can the variation in this process be captured *between* subgroups?
  - How should we draw the subgroup samples?
  - Is there too much variation *within* subgroups (are control limits artificially wide)?

How to Develop Rational Subgroups

1. Consider the data source(s) and **select the constant**. For example, the constant may be a machine, plant, shift, etc.

2. Examine variability among the sources of data in order to **define an appropriate subgroup**. To do so, consider the following questions: What subgrouping strategy would produce ranges reflecting the highest within-sample variation? What strategy would produce ranges having the lowest within-sample variation?

3. Establish the subgroups and **calculate the range of variability for each group**. The variation is within subgroups, not between them. Note: If you are uncertain with the choice and fear you may have selected the wrong sub-grouping strategy, calculate ranges for both strategies and evaluate.

4. Use the understanding of how to group the data sources to move forward and **determine a sample frame for producing the desired control charts**.

Exercise

The manufacture of glass uses three different furnaces to make their glass. Each furnace has one operator that monitors their shift -- there are three shifts throughout a day -- 24 hours. At the beginning and middle of each shift, the operator adds new raw material to the furnace in order to keep the glass output constant over their shift.

Consider each shift:

Furnace			
	1	2	3

Operator			
	1	2	3

Raw Material		
	1st Add	2nd Add
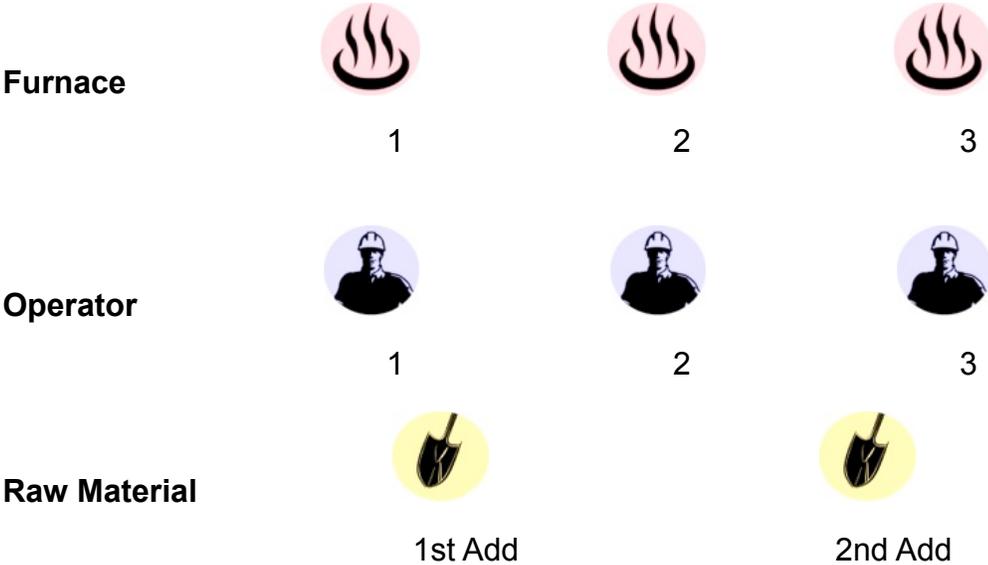
If you were going to start monitoring this process, what would be a good rational subgroup?