1.9 The Kappa Technique

MBC 638

Data Analysis and Decision Making

“No two things are alike, but even if they were, we would still get different values when we measured them.”

—D. Wheeler

Discrete Measurement Systems

Discrete Measurement Systems

Kappa Technique

$$K = \frac{P_{\text{observed}} - P_{\text{chance}}}{1 - P_{\text{chance}}}$$

Discrete Measurement Systems

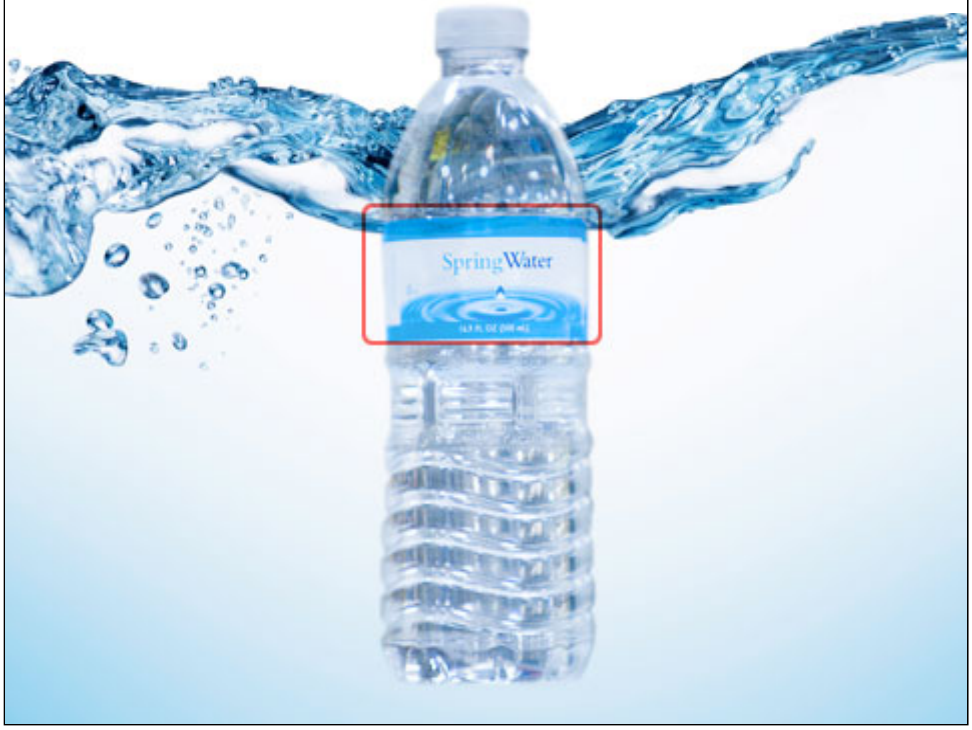
Kappa Technique

$$K = \frac{P_{\text{observed}} - P_{\text{chance}}}{1 - P_{\text{chance}}}$$

Discrete Measurement Systems

Kappa Technique

$$K = \frac{P_{\text{observed}} - P_{\text{chance}}}{1 - P_{\text{chance}}}$$



9 of 72

10 of 72

11 of 72

12 of 72

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

13 of 72

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

14 of 72

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

- $P_{\text{observed}} = 0.58$

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

- $P_{\text{observed}} = 0.58$
- $P_{\text{chance}} =$

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

- $P_{\text{observed}} = 0.58$
- $P_{\text{chance}} = (0.42)(0.67)$

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

- $P_{\text{observed}} = 0.58$
- $P_{\text{chance}} = (0.42)(0.67) + (0.58)(0.33)$

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

- $P_{\text{observed}} = 0.58$
- $P_{\text{chance}} = (0.42)(0.67) + (0.58)(0.33) = 0.47$

Between Operators: Reproducibility

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

- $P_{\text{observed}} = 0.58$
- $P_{\text{chance}} = (0.42)(0.67) + (0.58)(0.33) = 0.47$
- $K = \frac{0.58-0.47}{1-0.47}$

Discrete Measurement Systems (cont.)

Kappa Technique

$$K = \frac{P_{\text{observed}} - P_{\text{chance}}}{1 - P_{\text{chance}}}$$

Discrete Measurement Systems (cont.)

Kappa Technique

$$K = \frac{P_{\text{observed}} - P_{\text{chance}}}{1 - P_{\text{chance}}}$$

- If $K > 0.7$, measurement system is good.

Between Operators: Reproducibility (cont.)

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

- $P_{\text{observed}} = 0.58$
- $P_{\text{chance}} = (0.42)(0.67) + (0.58)(0.33) = 0.47$
- $K = \frac{0.58 - 0.47}{1 - 0.47}$

Between Operators: Reproducibility (cont.)

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

- $P_{\text{observed}} = 0.58$
- $P_{\text{chance}} = (0.42)(0.67) + (0.58)(0.33) = 0.47$
- $K = \frac{0.58 - 0.47}{1 - 0.47} = 0.21$

Between Operators: Reproducibility (cont.)

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

- $P_{\text{observed}} = 0.58$
- $P_{\text{chance}} = (0.42)(0.67) + (0.58)(0.33) = 0.47$
- $K = \frac{0.58-0.47}{1-0.47} = 0.21$
- Indicates that our measurement system is not good

Between Operators: Reproducibility (cont.)

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

- $P_{\text{observed}} = 0.58$
- $P_{\text{chance}} = (0.42)(0.67) + (0.58)(0.33) = 0.47$
- $K = \frac{0.58-0.47}{1-0.47} = 0.21$
- Indicates that our measurement system is not good

Between Operators: Reproducibility (cont.)

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

- $P_{\text{observed}} = 0.58$
- $P_{\text{chance}} = (0.42)(0.67) + (0.58)(0.33) = 0.47$
- $K = \frac{0.58-0.47}{1-0.47} = 0.21$
- Indicates that our measurement system is not good

Between Operators: Reproducibility (cont.)

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Me	G	G	G	B	B	B	G	B	B	B	G	B	5/12	7/12	
You	G	G	G	G	G	B	B	B	G	B	G	G	8/12	4/12	
	✔	✔	✔			✔		✔		✔	✔				7/12 = 0.58

- $P_{\text{observed}} = 0.58$
- $P_{\text{chance}} = (0.42)(0.67) + (0.58)(0.33) = 0.47$
- $K = \frac{0.58-0.47}{1-0.47} = 0.21$
- Indicates that our measurement system is not good

The disparity between quality ratings in the previous example is an illustration of a reproducibility problem.

Within Operator: Repeatability

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

- $P_{\text{observed}} = 0.75$

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

- $P_{\text{observed}} = 0.75$
- $P_{\text{chance}} = (0.42)(0.33) + (0.58)(0.67)$

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

- $P_{\text{observed}} = 0.75$
- $P_{\text{chance}} = (0.42)(0.33) + (0.58)(0.67)$
- $K =$

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

- $P_{\text{observed}} = 0.75$
- $P_{\text{chance}} = (0.42)(0.33) + (0.58)(0.67)$
- $K = \frac{0.75-0.52}{1-0.52} = 0.48$

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

- $P_{\text{observed}} = 0.75$
- $P_{\text{chance}} = (0.42)(0.33) + (0.58)(0.67)$
- $K = \frac{0.75-0.52}{1-0.52} = 0.48$
- Still too low: *K* should be ≥ 0.85

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

- $P_{\text{observed}} = 0.75$
- $P_{\text{chance}} = (0.42)(0.33) + (0.58)(0.67)$
- $K = \frac{0.75-0.52}{1-0.52} = 0.48$
- Still too low: *K* should be ≥ 0.85

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

- $P_{\text{observed}} = 0.75$
- $P_{\text{chance}} = (0.42)(0.33) + (0.58)(0.67)$
- $K = \frac{0.75-0.52}{1-0.52} = 0.48$
- Still too low: *K* should be ≥ 0.85

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

- $P_{\text{observed}} = 0.75$
- $P_{\text{chance}} = (0.42)(0.33) + (0.58)(0.67)$
- $K = \frac{0.75-0.52}{1-0.52} = 0.48$
- Still too low: *K* should be ≥ 0.85

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

- $P_{\text{observed}} = 0.75$
- $P_{\text{chance}} = (0.42)(0.33) + (0.58)(0.67)$
- $K = \frac{0.75-0.52}{1-0.52} = 0.48$
- Still too low: *K* should be ≥ 0.85 for a single reviewer
    - Higher than the standard for two person comparisons, > 0.7

Less variability is expected when a single person is executing a process.

Within Operator: Repeatability

	1	2	3	4	5	6	7	8	9	10	11	12	Good	Bad	Total Agree
Day 1	G	G	G	B	B	B	B	B	B	B	G	G	5/12	7/12	
Day 2	G	B	G	B	B	G	B	B	B	B	G	B	4/12	8/12	
	✔		✔	✔	✔		✔	✔	✔	✔	✔				9/12 = 0.75

- $P_{\text{observed}} = 0.75$
- $P_{\text{chance}} = (0.42)(0.33) + (0.58)(0.67)$
- $K = \frac{0.75-0.52}{1-0.52} = 0.48$
- Still too low: *K* should be ≥ 0.85
  - Higher than the standard for two person comparisons, > 0.7

Continuous Data Measurements

Continuous Data Measurements

The rule of thumb commonly used to determine if the measurement system is **capable** is to see if the measurement-to-total ratio is less than 10%:

$$\frac{\sigma_{\text{measurement}}}{\sigma_{\text{total}}} \leq 0.10$$